FIRE FIGHTING

A Practical Guide for Firemen and Auxiliaries

John J. McCarthy

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NEW YORK FIRE DEPARTMENT

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Grateful acknowledgment is made to all who, in any way contributed to the compilation of this modest manual.

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A Practical Guide for Firemen and Auxiliaries

by

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Ass't Chief of Department, in Command

NEW YORK FIRE DEPARTMENT

1942

the femack company • 205 west 19 street • new york city

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INTRODUCTION

IN HIS INAUGURAL ADDRESS before the City Council on January 1st, 1942, Honorable Fiorello H. La Guardia, Mayor of the City of New York and at that time National Director of Civilian Defense, after leading in recital of the Lord's Prayer, proceeded to tell how close we are to an air attack. "At this time," he said, "none of us has any choice in the work we should do. We must serve where we can best serve. Remember, this war will come right to our streets and residential districts."

Fulfillment of the Mayor's prediction can no longer be a matter of speculation. Debate as to whether or not sustained mass attacks are possible, or whether the danger is limited to single or small number nuisance raids, is no longer a profitable pursuit. The answer lies in the march of events, the future. We must be prepared for either of these thrusts. The Fire Department is prepared to utilize every piece of equipment at its command.

Firemen have no choice in the work they should do. The Fire Department is a leading division in New York's municipal army. If the enemy does get overhead, he will come equipped with incendiary bombs and explosives. Destruction of any part of this densely populated City, a blast at its Navy Yard, the razing of its militarily important bridges, the setting of its water-front afire, tumbling its skyscrapers—these and a thousand other targets, the Axis would consider as a blow to the nation's morale and as a weakening of offensive efforts.

When the war takes that turn, New York's Fire Department has a vital part to play. Just as vital as if its men wore khaki and manned anti-aircraft guns. It is a part, if the bombing of

London is to serve as criterion, that will find its way into the history books of generations to come. We of the Fire Department form an army of defense in this great City. There will be need of skill and intelligence, hard work and endurance, resourcefulness and valor. The smallest incendiary bomb may cost hundreds, even thousands of lives, and millions of dollars damage by means of the fire it starts.

The purpose of this book is frankly ambitious. It does not aim to teach the management of fires. It is not a full and exhaustive treatment of the subject of fire-fighting. It does not propose to take the place of years of training and experience and transform a civilian into a fireman, first grade. But its scope is wide and its purpose far-reaching. Prepared primarily as a manual of instruction for Auxiliary Firemen, its contents are ideal for all firemen and particularly for Probationary Firemen. It shall attempt to serve as a complete, though elementary, handbook so that those who concentrate will retain the vast amount of instructive material learned throughout their course of training. It should act as a constant reference and refresher. The tools used in fire-fighting operations are not only pictured, but explained. The various chapters are not the result of fancy theories. They are authoritative. Their source is New York's Fire College. And the College's findings and instructions are based on cold, hard facts, gleaned from thousands upon thousands of fires through the years.

Read your book. Study it. Become so familiar with it that no index is necessary. Transfer its phrases and pictures to a pocket in your brain. Your knowledge may mean human lives.

If, in good measure, the book achieves this worthy aim, if it helps to make an Auxiliary a competent wartime fireman, new appointees or firemen, generally, more efficient members, its compilation will not have been in vain.

Patrick Walsh

FIRE COMMISSIONER—CHIEF OF DEPARTMENT

The Auxiliary Fire Corps

SINCE THE MOST VITAL CONCERN OF THE FIRE DEPARTMENT at this time is the training of its Auxiliary Corps, this opening chapter will briefly explain the need and operating plan of this wartime organization.

Purpose

Why has the New York Fire Department formed an Auxiliary Corps? Because our Country is at war and, if our coastal defenses are successfully pierced, the enemy will attack New York City with all of the air power he can muster. But are there not enough regular firemen and sufficient apparatus in the Department to handle such a situation? Emphatically—NO! Our existing personnel and equipment is adequate to protect the City from the destruction of peace-time fires only. Even then, the Fire Service is occasionally in need of reserve help. The recent fifth alarm pier fire at 42nd Street and the North River caused the movement of one-fifth of all the apparatus in service. That was only *one* fire. Suppose several big fires raged simultaneously in the City. Suppose we had 10 or 110 fires of fifth alarm proportions going at the same time. London had that many, and more, in a single night. Confusion, panic and utter destruction would result unless the Department is supplemented by a properly trained and equipped Auxiliary Force, with additional apparatus.

Quota

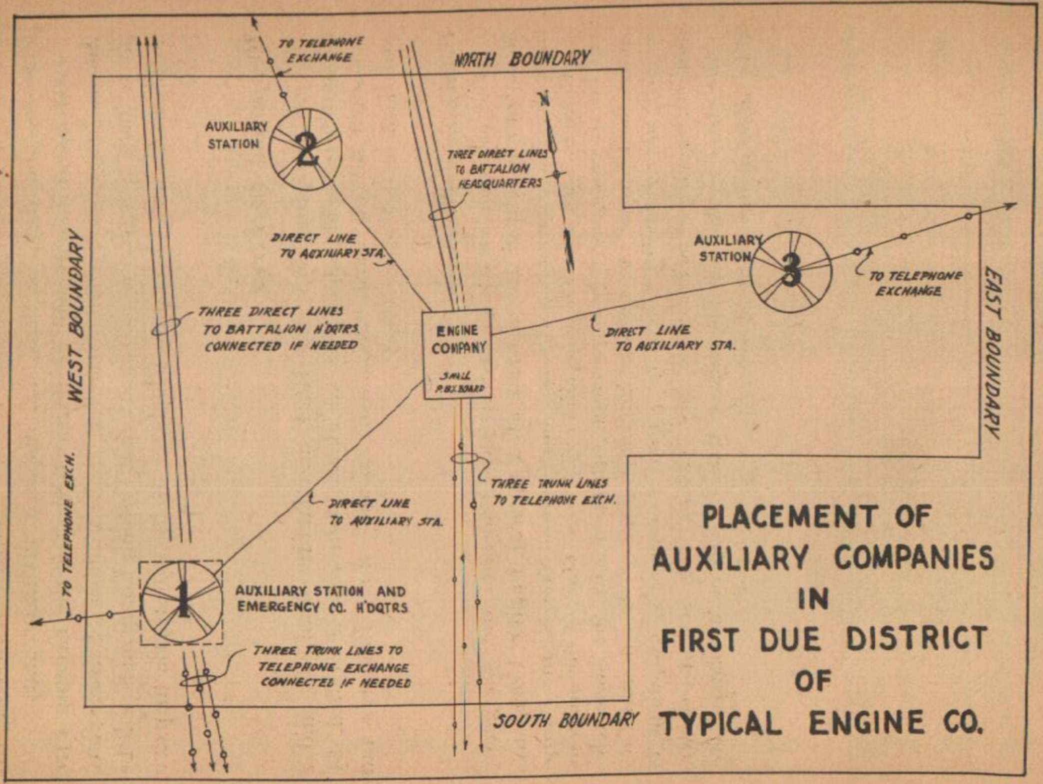
At least 60,000 active auxiliaries will be necessary to augment the regular force in order to give the City full protection against incendiary attacks from the air. Another 25,000 should be in reserve.

Auxiliary Set-up

The Auxiliary Force will be housed in their own quarters, with their own pumping apparatus and equipment. Each existing land company (Engine Co.) will be augmented, with a few exceptions, by two Auxiliary Stations, totaling 452 such wartime units in the City. The sites for these stations have already been selected, with the chief considerations directed at ample room for crew and apparatus, and such necessary facilities as sanitation and heating. In most instances, structures at present occupied as a City-owned building, a garage, a small structure, etc., will be converted to the use of wartime firemen; in other cases, where no suitable buildings have been found, new quarters will be constructed. Unless conditions change abruptly, the Auxiliaries will work under the command of designated officers in short shifts that will not interfere with ordinary employment.

Transmission of Alarms

When an Air Raid Warden observes, or is informed of a fire, he will pull the nearest Fire Alarm Box. If the Fire Alarm Telegraph System is functioning properly, the alarm will register in the Borough Central Office and, from there, will be sent out to the Fire Companies. Assigned units will then respond. However, the receipt of the alarm is checked by a secondary means. Immediately after pulling the box, the Air Raid Warden telephones the alarm to a Control Center that is equipped to receive all signals over the Fire Alarm Telegraph System. If the signal in question has been received by the Control Center, it is assumed that fire apparatus is on the way. If the alarm has not so registered, the Control Center directly notifies the Borough Central Office which, in turn, dispatches the proper Auxiliary Units. If the Borough Telegraph Office has been bombed out, the emergency office carries out the required function. If the both offices are "out" the Control



PLACEMENT OF AUXILIARY COMPANIES IN FIRST DUE DISTRICT OF TYPICAL ENGINE CO.

TO TELEPHONE EXCHANGE
NORTH BOUNDARY
N
AUXILIARY STATION
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THREE DIRECT LINES TO BATTALION HEADQUARTERS
DIRECT LINE TO AUXILIARY STA.
AUXILIARY STATION
3
TO TELEPHONE EXCHANGE
EAST BOUNDARY
WEST BOUNDARY
THREE DIRECT LINES TO BATTALION H'DQTRS. CONNECTED IF NEEDED
ENGINE COMPANY
SMALL P.BX.BOARD
DIRECT LINE TO AUXILIARY STA.
THREE TRUNK LINES TO TELEPHONE EXCH.
DIRECT LINE TO AUXILIARY STA.
TO TELEPHONE EXCH.
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AUXILIARY STATION AND EMERGENCY CO. H'DQTRS
THREE TRUNK LINES TO TELEPHONE EXCHANGE CONNECTED IF NEEDED
SOUTH BOUNDARY

Center will contact the regular Engine Company nearest the fire location, and they, in turn, will dispatch auxiliary units.

Alarms ordinarily will be transmitted over the existing Fire Alarm Telegraph System. However, if the number of fires multiply to such a degree as to overtax that system, Companies will be notified of alarms by radio, telephone or by motorcycle dispatch riders.

Response to Fires

One Pumping Unit, one Hook and Ladder Company and a Chief Officer will respond to an alarm, followed, if needed, by a limited second alarm assignment (usually three Pumpers and one Hook and Ladder Truck).

Company District

The drawing on the preceding page diagrams the emergency organization within the district of a typical Engine Company. Each Auxiliary Station will house one section, that is, one Pumping Engine, with its own complement of men. One of the stations will be an emergency headquarters, equipped with the same telephone facilities as the regular Engine Company. It will function as the Control Center when the parent Company's equipment is bombed or out of service for any reason. This station, shown in the chart as the third auxiliary station, will be a reserve site to be used in the event of necessity.

Tools and Fittings

In learning any trade or skill, the worker must first become acquainted with the ordinary and special tools used in the trade. He should learn their names, their peculiarities and their uses.

In like manner, a new Fireman should become familiar with the tools used in regular Fire Department practices. He should be readily able to distinguish between a reducer and an increaser, between a Y-connection and a Siamese connection, between an open nozzle and a controlling nozzle.

Thus, if his Commanding Officer orders him to "go back to the pumper, get a 3-inch by 2½-inch reducer and use it on that line," he will carry out the order correctly. Or if, in stretching a line, two male butts come together, he will immediately sense the need of a double female connection. Every tool should lose its mystery through constant handling.

The purpose of this Chapter, therefore, is to list and explain all the tools in common use in the New York Fire Department. Each tool is illustrated, with few exceptions. LEARN TO IDENTIFY THEM! LEARN TO USE THEM—WHERE AND HOW!

HYDRANT TOOLS AND FITTINGS

Hydrant Connection. (Fig. 1)

This connection, 10-feet in length, is used for rapid connection of hydrant to pumper. It is female at both ends. The end to be attached to the small (2½-inch) outlet of the low pressure hydrant is equipped with 2½-inch threads. This end should be attached first and made spanner tight. The other end, equipped with 4½-inch threads, is then connected to the nearest suction inlet of the pumper. When water is started in the hydrant, it forms a semi-rigid waterway feeding to your pumper the flow from hydrant.

Large Suction Connection. (Fig. 2)

This connection, 10-feet in length, performs the same work as the Hydrant Connection, but on a larger scale. It is 4½-inches in diameter at each end, and differs also from the Hydrant Connection in that one end is male and the other female. The female end is first connected to the large (4½-inch) outlet of the low pressure hydrant. The male end must be fitted with a double female 4½-inch swivel connection so that it may be attached to the 4½-inch suction inlet of the pumper.

The connecting of two of these Large Suctions together, male end of one to the female end of the other, forms the 20-foot suction length used in taking suction from a body of water such as a river or a lake. In this operation, the 4½-inch female end of the combined lengths is attached to the pumper's suction inlet; to the male end, which is lowered into the river or other body of water, the Suction Strainer and Rope are attached, as described in Fire Department Evolution No. 6.

Low Pressure Hydrant Wrench. (Fig. 3)

This wrench is designed to fit the operating nut and cap nuts of a low pressure hydrant, as well as to provide a spanner for tightening the female threads of Hydrant Connection to the butt of the hydrant. An arrow on the bonnet of every low pressure hydrant indicates the correct direction to turn the wrench for opening the hydrant.

High Pressure Hydrant Wrench. (Fig. 4)

This wrench is designed to fit the cap nuts, main valve nut and independent valve nuts of the High Pressure Hydrant. At one end of the wrench is a spanner for tightening the lugs of the High Pressure Gauge, as well as the lugs of the female coupling of the

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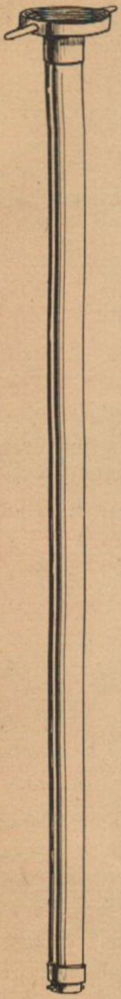

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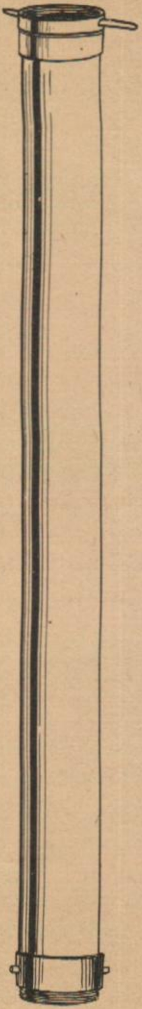

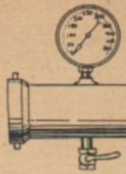

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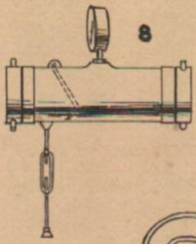

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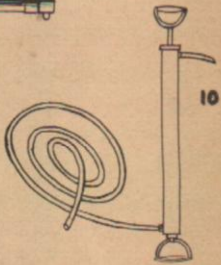

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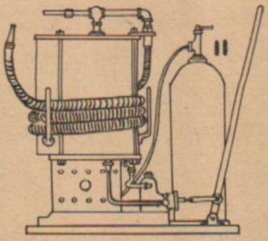

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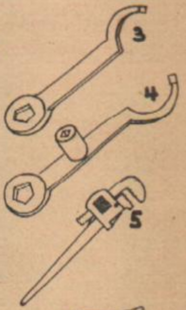

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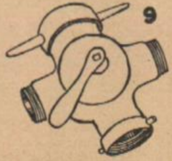

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hose attached to the gauge. The other end of the wrench presents an opening designed to fit the cap nuts and the main valve nut. The center of the wrench is designed to fit the independent valve nuts, and is raised, so that when operating on an independent valve nut, it clears the main valve nut.

Stillson Wrench. (Fig. 5)

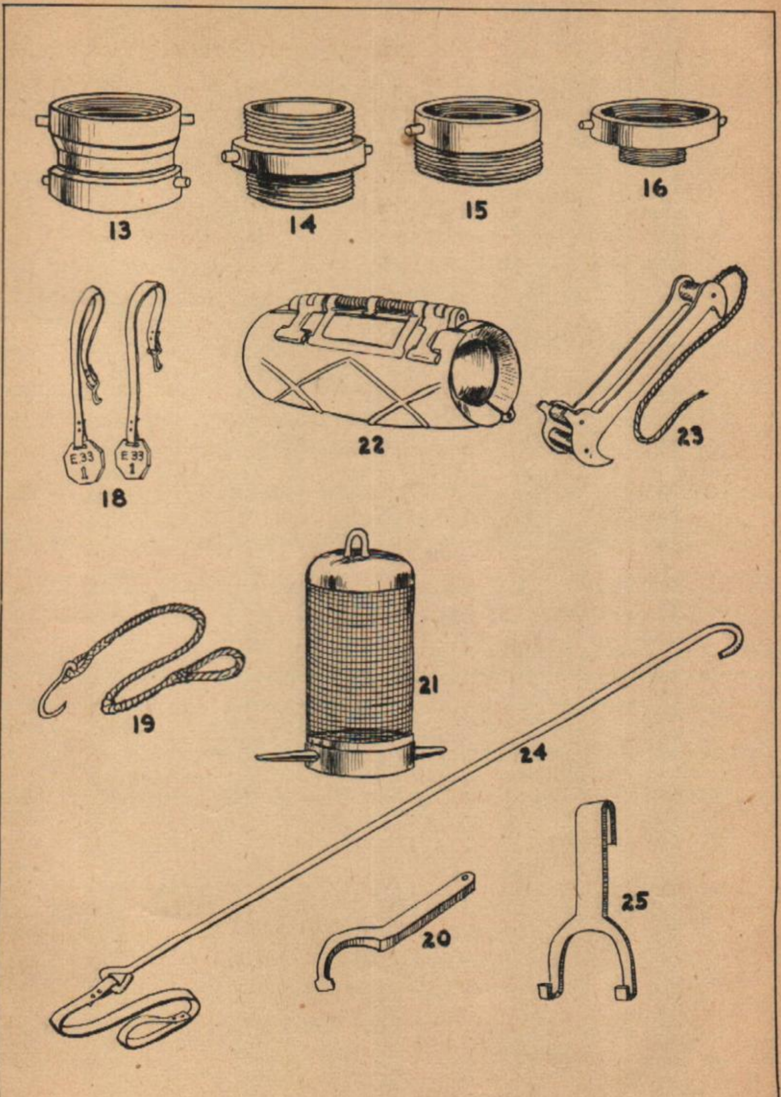
The common variety Stillson Wrench, used for tightening piping, bolts and nuts; its grip is based on leverage.

Hydrant Reducing Cap. (Fig. 6)

This fitting resembles the ordinary large hydrant cap. Instead of the nut at the center, however, it is equipped with either 2½-inch or 3-inch thread. Its usefulness may be best explained upon examination of a High Pressure Hydrant equipped with three 3-inch outlets and one 4½-inch outlet. The use of all four of these outlets at one time would not be possible unless the 4½-inch outlet was reduced to 3-inch equivalent. Being of larger orifice, it would "steal" water delivery from the lesser outlet butts. The attaching of a Hydrant Reducing Cap with 3-inch threads would make all outlets uniform and insure uniform delivery.

High Pressure Gauge. (Fig. 7)

This device consists of a short extension piece, 3-inch female on one end and 3-inch male at the other, with gauge and pet cock attached. The High Pressure Gauge is always used when working from a High Pressure Hydrant. The Gauge, which is tapped into the extension piece, records the pressure of the water from the hydrant in pounds per square inch as it enters the hose line. The female end of the device is attached to the butt of the hydrant; to the male end of the device is connected the female butt of the hose line. It is important that the pet cock be kept parallel with the line it is feeding, because when turned outward, it acts as a drain.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Coney Island Connection. (Fig. 8)

This device consists of a short extension piece, 2½-inch female threading at both ends, with gauge attached. As the name suggests, it is used principally at Coney Island, to prevent the impure water of the High Pressure System from backing into the Low Pressure drinking water supply. It is equipped with a clapper valve which opens in but one direction, so that water which passes through it into the High Pressure Hydrant may not flow back. It is prominently marked so that no mistake should be made as to which end of the device is attached to the hydrant. To relieve undue strain, it is equipped with a turnbuckle or support leg, which may be adjusted to span the space between the ground and the device.

New York Switch Valve. (Fig. 9)

This device, used at a Low Pressure Hydrant, to get a line into immediate operation without pressure assistance from the Pumper, is equipped with four gates; one 4½-inch female, one 2½-inch female and two 2½-inch males. It is also fitted with a switch valve so that the waterway may be quickly diverted. It could be attached by means of the 4½-inch female swivel to a hydrant before the Pumper has been able to take position for operation. Hose line is then attached to either of the 2½-inch male outlets, the switch placed in position to feed same, and the hydrant turned on. You instantly have a line at hydrant pressure. Your Pumper, however, is now in operating position. A Hydrant Connection is attached, its 2½-inch female end to the unoccupied 2½-inch male butt of the Switch Valve, its 4½-inch female end connected to inlet of the Pumper. A short length of 2½-inch hose (about 8 feet long) is stretched from the discharge gate of the Pumper to the unoccupied female inlet of the Switch Valve. The pumps of your engine are now engaged and with the lever on the Switch Valve adjusted, the water flows from the hydrant into the Pumper and is given pressure; it is then discharged from the discharge gate, back through the Switch Valve and into the line at increased pressure. This is accomplished without any interruption of the water flow.

Hydrant Pump. (Fig. 10)

A small pump operated by hand, in bicycle pump fashion, to remove water which will not drain from the barrel of a hydrant. It is equipped with a short length of rubber tubing for insertion into the hydrant outlet.

Portable Thawing Device. (Fig. 11)

This appliance is a steam throwing device designed to be carried on apparatus during Winter weather. It consists of a 2-gallon water tank, hand operated pump which forces the water from the tank into the coils which are heated by gas from a storage tank, and a line of steam hose and a nozzle. The water tank is filled through a small cap at top with one-half denatured alcohol and one-half water. This mixture is merely to prevent freezing when not in use. The gas tank containing Prestolite is connected to the burner base. The tank should register at least 80 pounds pressure to give the burner satisfactory heat for thawing. In operating this device, a lighted match is first placed over the gas burner through a porthole in a metal shield. The gas valve is opened slowly until the gas ignites, and then the opening is continued until a flame projects 8 to 10 inches above the top of the device. Start pumping water from the tank into the coils immediately, by operating the pump handle. At no time after lighting should the pumping be discontinued, as otherwise serious damage might result to the coils through overheating.

The pump handle should be operated at from 75 to 100 strokes per minute. Keep the nozzle in open air until steam escapes. When proper pressure is obtained, insert the nozzle into the hydrant.

McCarthy Disc. (Fig. 12)

A metallic disc, painted white, with either a 3-inch or 2½-inch hole at its center, so that it may be placed on the 3-inch or 2½-inch butt of a hydrant. The 2½-inch disc, when attached to a Low Pressure Hydrant, indicates that the hydrant is defective and cannot be used. A 3-inch disc on one or two of the independent outlets of a High Pressure Hydrant indicates that one or two of the independent outlets are unserviceable. A 3-inch disc, with a black stripe painted across the center, when found on the outlet nearest the roadway, indicates that the entire hydrant is out of service and cannot be used.

This disc is also used for indicating standpipe, sprinkler and other systems "out of service." It is adjusted to Siamese or single street inlets of defective systems.

HOSE FITTINGS

Double Female Coupling. (Fig. 13)

Equipped with female threads at both ends, this fitting is used to join two male ends having the same threads. It is to be noted that one end of this fitting is stationary and one end is swivel. Fire Department practice dictates "solid to solid," which means that the stationary end of the coupling should be attached first, leaving the swivel end for easy completion of the coupling operation. It is carried in various sizes, 2½-inch and 3-inch being the most common.

Double Male Connection. (Fig. 14)

Equipped with male threads at both ends, this fitting is used to join two female ends having the same threads. Its use is distinctly seen when a stretch is necessary that brings the female butt to the fire. The nozzle is female as well as the hose butt and a Double Male Connection has to be used. It is carried in various sizes, 2½-inch and 3-inch being the most common.

Increaser. (Fig. 15)

This fitting is equipped with female threads at the small side and male threads at the large side. It is used to connect a male butt of small diameter to the female butt of larger diameter. It is carried in various sizes—2½-inch to 3-inch, 3-inch to 3½-inch, 1½-inch to 2½-inch, etc.

Reducer. (Fig. 16)

The purpose of this appliance is to reduce the size of a line, or reduce the hydrant or engine outlet, to the size of a smaller hose coupling. It is equipped with female threads at the large opening and male threads at the reduced opening. It is carried in various sizes, 3-inch to 2½-inch, 3½-inch to 3-inch, 2½-inch to 1½-inch, etc.

Double Female Reducing Swivel. (Fig. 17)

This connection is used for bringing two male ends together where these ends are of different diameter. It is equipped with female threads at both ends. The smaller end is swivel and the larger end is stationary. The common type, 4½-inch to 2½-inch double female reducing swivel is frequently employed in conjunction with the Large Suction.

Hose Tag. (Fig. 18)

A small metal tag with strap attached. The metal tag is stamped with the Engine Company's number, as well as a small identifying set number. At large fires, where many lines are stretched, the employment of a set of tags, one at pumper or source of supply and one at the nozzle, identifies the line definitely, and does away with confusion.

Hose Strap. (Fig. 19)

A short length of small diameter rope with metal hook attached. Every fireman carries a hose strap on his person, for it has many uses. The rope end has a loop and the passing of the hook end through the loop enables a fireman to use the Hose Strap to fasten a hose line to a banister of a stairway, or the rung of a ladder, thereby lessening the strain and the chance of the line slipping.

Hose Spanner. (Fig. 20)

A small wrench carried by all firemen for tightening hose connections by means of the lugs on the female swivel end. Larger spanners for heavier use are carried on all apparatus.

Suction Strainer. (Fig. 21)

A basket-like device of metal with many tiny holes, designed to permit the entrance of water, but to keep out foreign objects. It is equipped with 4½-inch female threads and is connected to the large suction when about to draft water from a river or other body of water.

Hose Jacket. (Fig. 22)

The purpose of a Hose Jacket is to stop leaks in hose. Where a line of hose bursts and the tear is not longer than the hose jacket, the device can be used very effectively for stopping the loss of water and keeping the line in service. The method of using the Hose Jacket for a tear in a hose is to so place the tear that the water will be shooting away from the operator and as nearly horizontal as possible. When ready, the upper part of the jacket is snapped closed quickly, preferably with the foot. It locks automatically. Hose Jackets come in various sizes to fit the various sizes of hose, 2½-inch, 3-inch, etc.

Acquaintance with this device will soon teach that it may also be used, in emergency, as a universal coupling, to connect up two lines of hose of different threads, or even of different diameters.

Hose Roller. (Fig. 23)

This device consists of a metal frame so constructed that it will fit over a window sill or the edge of a roof cornice. It is used when hoisting hose to the roof or upper floor of a building. It reduces friction on the rope, insures the rope against injury and lessens the labor of the operating force. It contains two rollers over which hose or ropes may be drawn with little twisting. The roller itself has a stout rope attached so that it may be made fast to a substantial object before being put to use.

Fire Escape Hook. (Fig. 24)

A metal rod 15 feet in length, with a blunt hook at one end and a loop strap at the other end; a valuable device in advancing a line quickly up a fire escape. Attach the strap loop of the Fire Escape Hook around the hose line about two feet back from the nozzle. If the hose line is in fairly neat fashion on the ground the rod may be advanced from balcony to balcony swiftly and easily, using the hook end for hanging it on each succeeding balcony.

Hose Hanger. (Fig. 25)

A small metal device with hooked ends for gripping the lugs on the male butts of lengths of hose, and used for hanging the hose to dry in the hose tower at quarters.

Hose Cover

A tarpaulin cover for protection of hose on apparatus during rain or snowstorms.

Controlling Nozzle (Fig. 26)

The ordinary Controlling Nozzle is of brass and is composed of three parts—the base, which houses the shut-off valve, the barrel and the tip. Controlling Nozzles come in various sizes—¾-inch, 1-inch, 1⅛-inch and 1¼-inch openings. They are particularly useful in inside work because control of its discharge is in the hands of the man at the nozzle. Shut-off of this nozzle is accomplished by a roller valve which, to open, should be drawn slowly toward the operator. Some Controlling Nozzles of older design will be found in the "job" that work in opposite style, that is, the nozzle is opened by slowly pushing the handle-lever away from the operator.

The style of nozzle you are going to be called upon to work with should be studied and familiarized, long before its need for operation.

Tip. (Fig. 27)

Tips come in various fractional inch sizes and are equipped with female threads so that they are easily connected to or taken off the Controlling Nozzle. The Tip is carried attached to the Controlling Nozzle, and its chief purpose is to reduce water damage. Its use or removal, upon encountering a fire, is under the supervision of the Officer in Command of the line.

Open Nozzle. (Fig. 28)

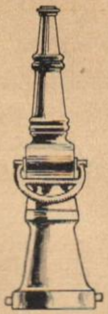
The Open or Smooth Bore Nozzle is of brass and differs from a Controlling Nozzle in that it possesses no means of shut-off. Once in operation, its control is from the source of water supply. The Open Nozzle is principally for outside operation where it is likely to remain in continuous operation on a fire of large proportions. Open Nozzles come in various sizes—1⅛-inch, 1¼-inch, 1½-inch, 1⅝-inch, 1¾-inch and 2-inch and are usually used in conjunction with one of the Pipe Holders.

Play Pipe. (Fig. 29)

A brass or chromium-plated assembly of nozzle tip on a long piece of pipe. Used mainly where a stream of long duration is required and its extra range of throw is desirable. Female threads make it easily adjustable to the male butt of hose line. Male threads at its other end make possible the attachment of whatever size tip is desired. The Play Pipe is equipped with a stick, or metal rod, for supporting the Pipe against nozzle reaction.

Fog Nozzle. (Fig. 30)

The Fog Nozzle, a comparatively recent introduction, is either of brass or chromium-plate, and operates in the same manner as the small garden-hose nozzle. It is equipped with a screw valve that regulates the circular curtain-spray thrown from its tip. It is particularly useful where a spray stream is desired, and has been found very helpful in cellar-fire work where the spray-curtain



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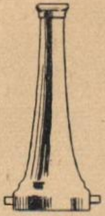

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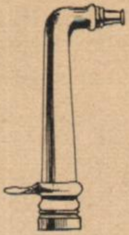

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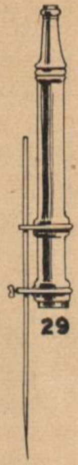

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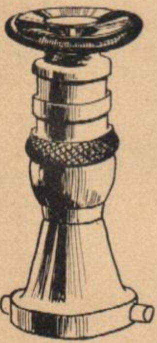

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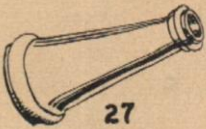

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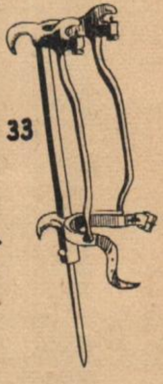

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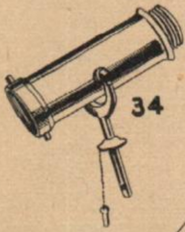

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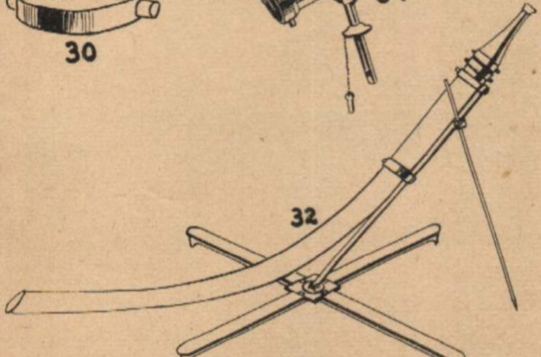

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acts as a circular shield to push back the dense smoke. The newest type may be adjusted to provide a solid stream by opening fully.

New York Nozzle. (Fig. 31)

A nozzle device used in conjunction with the base of a controlling nozzle, for effective use on fires in walls, partitions, ceilings, etc. It is equipped with a bent tip and a revolving collar, which enables operator to shoot the stream in any desired direction. Fitted with female threads, it is easily attached to the base of a Controlling Nozzle, which gives its operator the advantage of being able to shut the stream off, or on, as ordered.

Paradox Pipe Holder. (Fig. 32)

This device consists of two main parts: a hose support with 3-inch and 2½-inch adjustable collars and an adjustable rod forming one part, and a heavy metal base forming the other. To put in operation, set the base (which consists of four short pieces of metal hinged to a common center piece) so that the key slot in the center piece points away from the building into which the stream is to be operated. Insert the key of the hose support section into this key slot, and make a half turn with it, thereby securely locking the base. The hose is then placed in collar and the adjustment rod set in a vertical position. When the holder is set at the desired position, lock thumb screw on to the adjustment rod, and tap end of each of the 4 short pieces of the base with the back of an axe, to give them proper security. The stream may be manipulated from side to side and raised or lowered by regulating the adjustment rod. Its use is for outside streams of heavy pressures.

Perfection Pipe Holder. (Fig. 33)

This device, similar in purpose to the Paradox, is of lighter weight and construction, and therefore better for roof or fire escape work. It is equipped with two spring catches which should be snapped on the lugs of the male butt of the hose, and with straps which should be fastened about the hose to make it additionally secure. It has a metal stick, or holder, which permits it being placed against the ground for support. This stick or holder, when not in use, is carried telescoped within a section of pipe comprising the back of the holder.

Rail Pipe. (Fig. 34)

These appliances are used chiefly on fire-boats. Their function is to provide a fixed means of control for hose lines, where large size nozzles, at high pressures, are employed.

HEAVY STREAM FITTINGS

Single Gate. (Fig. 35)

The Single Gate is a short length of pipe, male at one end, female at the other, with a hand operated valve attached to enable its opening or shutting at will. This valve may be so operated as to only partly close, thereby reducing pressure in a line. The Single Gate is particularly useful when using Cellar Pipes or Distributors or Open Nozzles, thereby providing a means of shut-off without going to the source of supply. Single Gates are manufactured for different sized hose diameters.

Two-Way Gate; Three-Way Gate and Four-Way Gate. (Fig. 36)

These devices are for dividing one line into two or more lines, and are fitted with female threads at the single inlet, and male threads at the 2-way, 3-way or 4-way outlet. Each outlet is equipped with a hand operated valve as in the Single Gate, permitting the use of one or more outlets, as desired. It is particularly useful when its inlet is of large diameter, thereby permitting the feed of several smaller lines at adequate pressures.

Y-Connection. (Fig. 37)

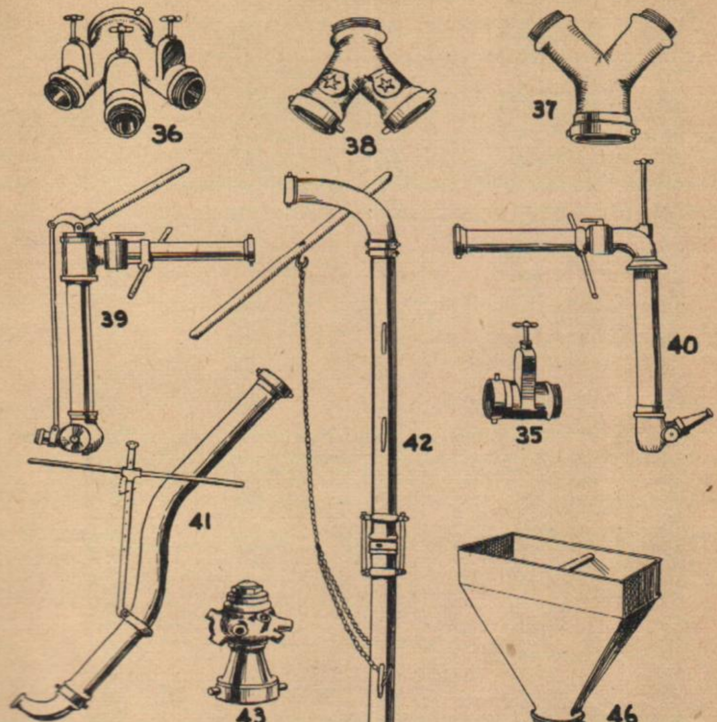
The Y-Connection is a fitting used to split one line into two lines. It is distinguished from the Siamese Connection by the fact that the stem is fitted with a female connection, while the two branches are fitted with male connections. It also differs from a Siamese in that it has no clapper valves. Y-Connections are to be found in various sizes, the most common of which are one 2½-inch to two 2½-inch, one 3-inch to two 2½-inch, and one 3½-inch to two 2½-inch.

Siamese Connection. (Fig. 38)

The Siamese Connection is used to bring two or more lines into a single line. It is fitted with female threads at the two or more inlet branches, and with male threads at the single outlet. Siamese Connections are provided with clapper valves (small hinged discs) inside the inlet branches to insure the water traveling in but one direction—toward the single line. Stars are stamped on the fitting to indicate to the man placing it in operation which end should be upward. Siamese Connections are to be had in various sizes, and are particularly useful in developing one strong stream of heavy calibre, out of several smaller streams.

Baker Cellar Pipe. (Fig. 39)

The Baker Cellar Pipe, like all cellar pipes is for use in getting an effective stream at a point where men cannot operate due to smoke, heat or obstructions. The Baker Cellar Pipe is of five principal parts; a straight length of pipe with female threads at one end for attachment to the male butt of hose that feeds it, and male threads at the other end; a perpendicular length of piping with female threads at one end for attachment to the straight or horizontal pipe and a curved or elbow termination with male threads; a tip for attachment to the elbow termination; a rod for insertion at the top of perpendicular piping to direct the throw of stream; another metal rod for attachment to the perpendicular piping to lay across the hole out in the floor, and prevent the device from falling through. Its range is less than an ordinary nozzle due to the sudden change in direction of stream at point where water enters the tip, but when operated properly by hand,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with constant change in the direction of the stream, it is of great value in cooling a cellar to a point that will permit advance of a hand line.

Hart Cellar Pipe. (Fig. 40)

The Hart Cellar Pipe is similar to the Baker Cellar Pipe in purpose, and has but minor mechanical differences. In the Hart Cellar Pipe, the rod controlling the nozzle movement is inside the vertical pipe, and being vertically above the nozzle, the operator must stand over the hole into which the pipe is inserted. A spray, however, just below where the pipes join, is provided to prevent smoke and heat from coming through the hole.

Bent Cellar Pipe. (Fig. 41)

The Bent Cellar Pipe is of wrought iron and consists of three sections, two curved pipe sections and a nozzle tip. To the middle section of pipe a cross-bar is attached by a clamp. This cross-bar spans the hole through which the Bent Cellar Pipe is placed and is fastened to a vertical strip by a pin. Holes at intervals permit adjustment to get different heights above the pipe. The Bent Cellar Pipe has female threads at inlet side to permit connection of the male butt of hose feeding same. Its range of throw covers a larger area than that of the Hart or Baker Pipes.

Sub-Cellar Pipe. (Fig. 42)

The Sub-Cellar Pipe is of much greater length than the Bent Cellar Pipe. It is of wrought iron and consists of three sections. The lower section, in the form of an elbow, holds the tip. The center section of straight piping is for depth of penetration. The upper section, an elbow also, is attached to the hose. To the lower section is attached a fastening to accommodate the chain and cross-bar which is placed across the hole the pipe enters for support. To rig it up the three sections should first be joined together, making sure that they are in line. Attach chain in eye in lower section and other end to the cross-bar. Hose connected before pipe is lowered, using gate valve between hose and Sub-Cellar Pipe.

Bresnan Distributor. (Fig. 43)

This distributor is largely confined to use in cellar fires, or to fires such as on ship-board where the department must operate through deck or flooring to a fire below. Its operation is somewhat similar to a large sprinkler head, throwing water in all directions through its nine orifices. It is equipped with 2½-inch female threads for connection to the male butt of a line of hose. A gate valve should be used, between the length of hose bearing the distributor and the next length toward the source of supply.

Bonner Distributor. (Fig. 44)

This distributor, which is also known as the Spherical Distributor, differs in mechanical construction, although used for the same purpose, as the Bresnan Distributor. It distributes its water by means of two "S" shaped nozzles on each side. These small nozzles revolve in opposite directions and discharge four ¾-inch streams. It is equipped with 2½-inch female threads and, as the Bresnan Distributor, calls for the use of a gate valve.

Heffernan Distributor. (Fig. 45)

This distributor is for use in ship fires. Its threads are 3½-inch female for connection to the male butt of 3½-inch fireboat hose. It consists of one main cylindrical center from which small nozzles protrude. When in operation, the cylinder revolves and permits the irregular nozzles to cover a large fire area. In lowering the Heffernan Distributor for use, a roof rope should be tied around the Distributor and male butt to which it is attached, using the clove hitch and binder knot. This enables the operator to move it around to different positions in the hatch or hole in which it is placed. A gate valve should be used between the length of hose bearing the Distributor and the next length toward source of supply.

Foam Generator and Hopper. (Fig. 46)

A device which may be transported from point to point and which generates a continuous stream of foam for use on oil and grease fires. Its operation consists of feeding powders into a hopper (or funnel) for forcing water, under pressure, from fire engines or hydrants through an ejector type of device which draws the powder in and mixes it with water, producing foam as desired. The New York Fire Department orders that one length (50 feet) be stretched from pumping engine to generator, and two lengths (100 feet) from the generator, for best results. The powders are not poured into the hopper untill 100 lbs. pressure shows on the gauge, which is attached to the generator.

FORCIBLE ENTRY TOOLS

Axe. (Fig. 47)

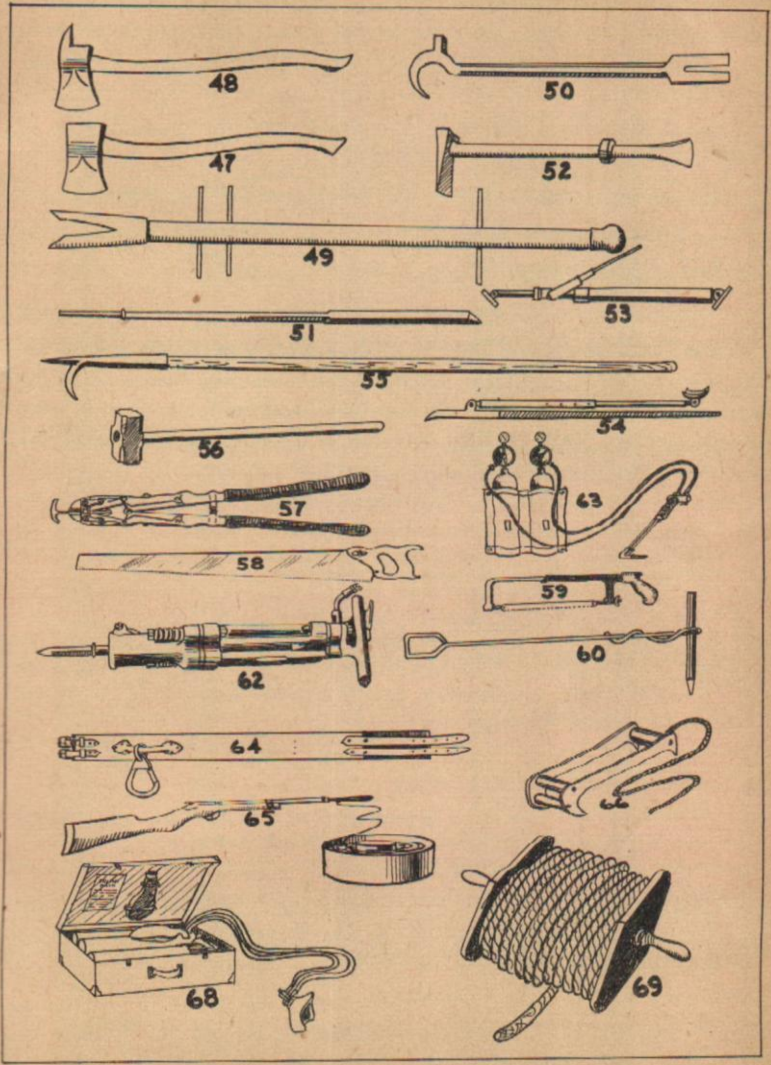
The Flat-head Axe is one of the most commonly used tools in the Fire Department. To an experienced fireman its adaptability to special uses makes it very valuable at fires. It may be used for cutting floors for making holes for cellar pipes and distributors, opening up for ventilation, and any other heavy cutting job that may present itself. It is also of extreme value in overhauling operations, opening up window frames for inspection, removal of flooring, etc. The common Flat-head Axe should have an unpainted wooden handle. It is frequently used as a sledge or maul.

Pike Axe. (Fig. 48)

The Pike Axe is not as generally used as the Flat-head Axe. Its one advantage over the Flat-head Axe is the pick on the back of the head, which may be used for prying up flooring and for similar operations.

Battering Ram. (Fig. 49)

The Battering Ram is a heavy implement for forcing heavy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doors and breaching walls. It is ball-shaped at one end and fork-shaped at the other. The ball-shaped end is for ramming doors, etc. The fork-shaped end is most useful in driving in the bricks and breaching a wall. The Battering Ram is equipped with two handles. Four men are used in operating it, one on each side of the two handles. Sometimes a fifth man is used at the butt end to assist in swinging it when a particularly tough job is met.

Claw Tool. (Fig. 50)

One of the most useful tools of a fireman. Fork or wedged-shaped at one end and hooked at the other, it performs a hundred tasks. It is particularly effective in breaking locks, opening doors, forcing windows, lifting iron shutters and prying open rolling doors. It is equally effective in opening up for ventilation or for getting at fires in such a manner as prying up the boards on the roof, after the tin has been cut away, removing lath and plaster, opening wainscoting and baseboards, and even ripping off shingles.

Crow Bar. (Fig. 51)

The Crow Bar in Fire Department work is used for prying up heavy planking and moving heavy obstructions. It operates on the principle of a simple lever.

Lock Breaker. (Fig. 52)

The Lock Breaker is wedge-shaped at one end and adz-shaped at the other. Like the Claw Tool, it is of heavy metal and is a useful small tool. In operating to open up a stubborn door, the adz-shaped blade is inserted between the jamb and the edge of the door, near the fastening or lock. The handle is then drawn outward, bringing the lock or bolt away from the catch. Very effective where there is but little room, as it can be driven in with an axe. The wedge-shaped end is useful for prying up flooring, etc.

Hale Door Opener. (Fig. 53)

Operates on a ratchet principle. Place the top compression piece under the lock on the door, if possible, being sure the base of the tool has firm footing. Operate the handle like that of an automobile jack, until the door gives. Be sure the compression piece is placed against a solid part of the door.

Detroit Door Opener. (Fig. 54)

Operates on the lever principle. As with the Hale Opener place the compression piece of the tool under the lock while the lever handle is level with the ground. When the compression piece is set, raise the lever handle until the door gives. The tool can be made to reach a lock at any height from the ground by adjusting the inner piece which telescopes into the piece attached to the lever.

Hook. (Fig. 55)

Hooks come in various sizes up to 25 feet. The most commonly used hook is the 6-foot hook, a wooden implement with a metal point and hook. There are many uses to which the 6-foot hook may be put, but the most common one is removing tin or plaster ceilings. For this purpose, drive the point into the ceiling and draw the hook toward you. Do not stand under the hook, but instead, stand back from it, with the hook pointing downward and from you. When removing tin from a roof with a hook, if the tin holds stubbornly, use the hook as a lever to pry it up. Cupping the hand beneath the hook when driving it into a ceiling enables the operator to get the benefit of more arm strength. This tool is also useful in prying a skylight from its position and in opening up windows on the floor below the roof.

Mall. (Fig. 56)

The Mall is nothing more than a heavy sledge. It has numerous uses, the chief of which are breaking deadlights, breaking through concrete flooring, and similar operations. When using it to break deadlights, be sure to hit with the Mall at an angle, for if it is used in such a manner as to hit the deadlights squarely, it is likely that the head will crack off, possibly causing injuries.

Electric-Wire Cutter. (Fig. 57)

A scissors-like tool used, as its name implies, for cutting wire. At fires where electric wires have fallen or are hanging, there is great danger to men working nearby. The Electric Wire Cutter has rubber handles and is considered safe, but the Fire Department takes an extra precaution by providing the man using the tool, with rubber gloves. Cut the wires where they are attached to the ceiling, so that the dead end will fall and live end remains attached to the ceiling.

Saw. (Fig. 58)

The common saw is used in the Fire Department for numerous cutting jobs.

Hack-Saw. (Fig. 59)

The Hack-Saw is a machinist's tool, but frequently comes in handy for forcible entry work. It usually consists of an adjustable holder to take 10 or 12 inch blades, and a handle attached to the holder, which serves as a means for operating the Saw. It is very useful on metal bars.

Rivet Cutter. (Fig. 60)

While this instrument was originally designed for cutting off rivets on iron shutters, trap doors, etc., its chief use developed into cutting holes through concrete flooring for insertion of cellar pipes. The Cutter is used with a Flat-head Axe or Mall for driving force.

Combination Punch and Chisel. (Fig. 61)

Useful for splitting planking to get a lock-bolt out. Drive it in with the back of an Axe until the plank opens up and the bolt can be removed. The chisel is used to a great extent in cutting off bolts in metal trap doors, such as are found on covers of stoke holds. The chisel can be used also for cutting thin metal doors found in the rears of theatres, and where there is no other method of opening them up.

Pneumatic Drill. (Fig. 62)

Known also as an air-gun, this tool is powered by compressed air fed to it from a mobile machine through rubber air-hose. It is the same as the tool used for excavations through rock and for the rapid removal of street surfaces. In Fire Department practices, it is used in opening up the concrete decking and heavy timber under-flooring of piers, where the use of other cutting tools is too slow and laborious. It may also be employed in breaching thick walls.

Acetylene Cutting Apparatus. (Fig. 63)

This torch is often more effective on steel construction than any other forcible entry tool. Steel Doors, grating, bars and other steel obstructions may be cut away by the torch. Like any acetylene torch, it cuts the metal away by heating it to the molten stage, then blowing the molten metal out with an oxygen blast, a part of the metal being oxidized in the intense heat. In addition to the torch a cylinder of acetylene gas and one of oxygen, both with regulators, are required.

Tin Cutter. (Fig. 70)

The tin cutter is used principally for ripping up tin roofs. It consists of a wooden handle to which is attached a sharp can-opener-like edge. Drive the point of the tool through the tin of the roof and use for cutting in can-opener style. Work with your back to the wind to prevent unnecessary punishment from smoke and hot gases which may come up as you roll back the tin roofing.

Ball and Chain. (Fig. 71)

Sometimes called a Window Breaker. The use of this device is rare. When breaking windows, the man who is to operate the device goes to the roof above the fire, or a window above the fire floor, and plays the chain out until the ball hangs even with the window to be broken. Holding firmly on the chain (or rope attached to the chain), the ball is thrown outward and sweeps downward, striking the window, driving the glass inward.

Wedge. (Fig. 72)

A short metal implement to be used with a mall or an axe for spreading timbers, etc. May also be driven into timbers or walls to provide hand and foot holds.

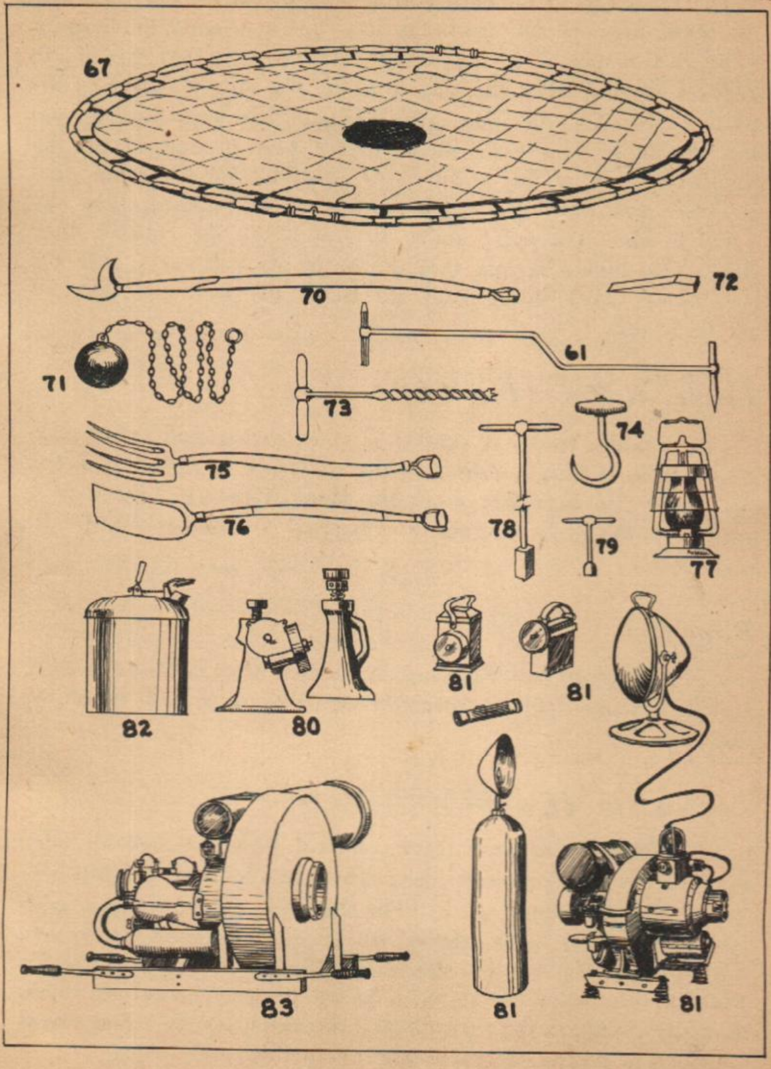
RESCUE TOOLS

Life Belt. (Fig. 64)

A wide belt of heavy leather which fits about the waist and fastens with double straps and buckles. Equipped with a snap hook which easily fits around and snaps on the rung of a ladder, it is not only a valuable device in rescue work, but also a very useful aid when operating lines from ladders. In adjusting the belt, it should be remembered that the hook opens at the left to allow quick "snap-on".

Life Gun and Rope. (Fig. 65)

The Life Gun is used to shoot a projectile, with line attached, to persons in peril who cannot be reached in any other way. Roof ropes are then made fast to the line to be drawn up by the person in danger. It may also be used for getting a line to men operating on the roof of a building. The Life Gun shoots a slug to which a heavy cord is attached. The Roof Rope is fastened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to the other end of the cord and as soon as the cord has reached its destination on the roof, the life line is hoisted up thereby. Cord is first placed in the canister and so laid that it will not become tangled when the slug is fired. The slug attached to the cord is placed in the gun, after the gun has been loaded, and the charge is then fired. It is always best to work from the windward side of the building, if possible. In using the gun, it should first be aimed at the cornice of the building, then elevated to aim at a point about 20 feet above the cornice, then fired. This makes certain that the projectile will carry over the cornice of the building, and not strike the face and rebound to the street.

Ladder Roller. (Fig. 66)

The Ladder Roller is similar in construction and appearance to the Hose Roller. It differs in that it is not equipped with the two projecting lugs that mark the Hose Roller. It fastens to a cornice in the same manner, and is used for raising ladders to high points.

Rope Net

A large net of heavy roping, surfaced with a light coat of tar for protections against deterioration, used as a last resort in rescue work.

Canvas Net. (Fig. 67)

The Fire Department carries several makes of canvas nets; the Browder, the Atlas and others. These nets mark a vast improvement over the old rope nets in that they are equipped with springs to lessen the impact of the jumper. They are also made with circular rim handles that snap into full spread position for firm holding, when the net is to be put to use. The net, however, as a life saving device, should only be employed as a last resort when other means of rescue are impossible.

Inhalator. (Fig. 68)

This device is employed for resuscitating persons overcome by gases and smoke, as well as for resuscitating persons whose lungs have become congested or otherwise affected so as to tend toward suffocation. Two cylinders filled with a mixture of oxygen and carbon dioxide (93% oxygen and 7% carbon dioxide) under pressure are coupled to a manifold in which a gauge is inserted. By operating valve on cylinder, the mixture flows to high pressure reducing valve and then through measuring dial marked in liters to indicate rate of flow, thence into rubberized cloth reservoir, from whence it flows to the patient through rubber hose and fitted face mask. As one cylinder becomes exhausted, supply from a reserve cylinder may be obtained by simply opening its valves.

Stretcher

The ordinary Stretcher for use in removing injured persons.

Roof Rope and Reel. (Fig. 69)

The Reel contains 150 feet of 1-inch rope coiled for ready use. The Roof Rope is used extensively in Fire Department operations, in rescue work, hose hoisting, ladder lifting, etc. For efficient use of the Roof Rope, a thorough study of Fire Department knots should be made.

OVERHAULING TOOLS

Auger. (Fig. 73)

The Auger receives but occasional use. It is no different than any machine shop auger, and is used to make holes in flooring to relieve excessive water. In using this tool, care must be exercised to keep the bit from striking nails or other metal. The safest method is to drill the hole away from the joists, keeping the bit well in the center of the board.

Cotton Hook. (Fig. 74)

The Cotton Hook is nothing more than one of the well known bundle hooks, so commonly used in handling boxed and baled freight. It is employed by firemen in handling baled material, such as cotton, rags, hay, etc.

Fork. (Fig. 75)

The Fork is used chiefly at fires for overhauling purposes; where it is necessary to move or handle hay, straw and other similar materials.

Salvage Covers

Salvage Covers are carried only by the Fire Patrol Companies, and are used to prevent or minimize damage to property by water and debris. A good Salvage Cover is made of closely woven canvas, so closely woven that it will hold water. These covers are further waterproofed by a chemical process. They are commonly 12 feet by 18 feet in size.

Shovel. (Fig. 76)

Two types of shovels are commonly used in the Fire Department, the flat shovel and the scoop shovel. The uses of these tools readily suggest themselves.

SPECIAL HAZARD TOOLS

Rubber Gloves

Rubber Gloves are primarily used as a protection against shock from live electrical apparatus or wiring. They may also be used in handling chemicals, which otherwise might injure the hands. They should always be worn when using the Electric Wire Cutter, as an additional safeguard when cutting wires that are live or suspected to be so.

Lantern. (Fig. 77)

The Lantern is of common usage in the Fire Department as a warning device. Lanterns with ruby globes are carried on all apparatus for this purpose.

Flag

Red Flags are carried on all Hook and Ladders and Rescue Wagons for use as warning devices in daylight.

Gas Key. (Fig. 78)

The fusing or breaking of gas pipes at fires is occasionally the cause of explosions and even loss of life, to say nothing of the additional trouble the presence of leaking gas gives to firemen in getting the fire under control. The Gas Key or Combination Gas Shut-Off is a device with three interchangeable keys which will fit almost any gas cock encountered. The proper place to shut off is at the point where the supply of gas enters the building. Many buildings are equipped with a shut-off device at street entrance which this key fits neatly.

Subway Key. (Fig. 79)

A long "T" shaped metal key that fits into the slot provided on all subway emergency exits.

Jack. (Fig. 80)

Jacks, in the fire service. find their chief use in lifting heavy objects such as trolley cars, railroad cars, etc., in the event of an accident. They are also of great assistance in various phases of building collapse work. The New York Fire Department uses Jacks of the Screw type and also of the Hydraulic type.

Portable Lights. (Fig. 81)

Quite a variety of portable lights are used in fire service. They range from the small electric lamp employed by firemen and officers for inside work, to the large 1000-watt lamps carried on Searchlight Apparatus. Hook and Ladder Companies usually carry a carbide light, about the size of a 2½-gallon fire extinguisher. This light is equipped with a 10-inch aluminum reflector that can be directed at any angle.

Gas Safety Can. (Fig. 82)

A 5-gallon self-closing safety can for transfer of gasoline. Chiefly used at fires for carrying gasoline from the Fuel Wagon to pumping engines in need of fuel.

Portable Smoke Ejector. (Fig. 83)

Carried only by Rescue Company No. 1, this Portable Smoke Ejector receives its power from a Homelite 2-cylinder pumping unit. It is equipped with 12-inch flexible suction hose which is inserted into the area to be cleared of smoke or fumes. It requires four men to operate.

Evolutions

ASSUMING A THOROUGH STUDY OF THE PREVIOUS CHAPTER on tools, the embryo Fireman should be on familiar terms with at least the common tools used in the Department.

He is now in a stage of his training similar to that of a raw Army recruit, who has completed only the first part of his basic military training. The green soldier performs the manual of arms, marches with fair precision, cleans and shoots his gun, respects even his non-coms, rolls barbed-wire and obeys the bugle. He can do numerous isolated tasks. In short, he knows the *tools* of soldiering. He still must learn to unite several isolated actions into a single intelligent job. The infantryman must learn to follow the Tank Corps in an advance, adjust his gas-mask, shoot, be alert to avoid the strafing machine-gun fire of enemy planes — do all these actions in unison, and keep his head. The engineer must learn to extend lines of communication to a river's edge, throw up a pontoon bridge, tear it down, stack the planks and beams back in a truck, duck enemy fire, then advance. The soldier learns these coordinated operations while on maneuvers.

The new Fireman, with a good knowledge of tools, requires something comparable to the soldier's maneuvers to show him how these tools are related to each other and how they join together to enhance effective fire-fighting. The evolutions will fill this need. They are the fireman's maneuvers.

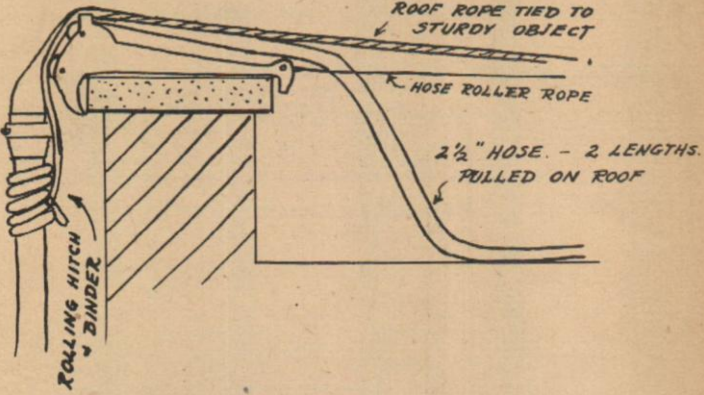
An evolution is a drill in a specific fire-fighting operation that is performed in a uniform manner throughout the entire Fire Department. The "Relay of Water" is accomplished the same way in Flatbush as it is in Harlem. There is only one correct way of "Raising a 35-foot Ladder".

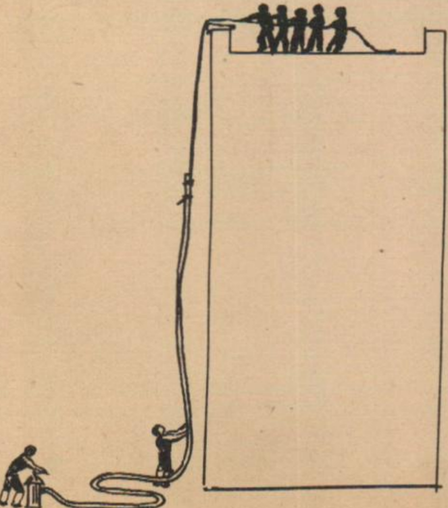
Analyze each evolution. Associate the drill with the condition where it applies. Think out the reason why each tool is used. Learn to perform the evolution yourself.

Following this introduction are 25 illustrations, depicting the correct manner of performing the 25 official Evolutions of the New York Fire Department.

EVOLUTION NUMBER 1

Stretching Hose Line to Roof, Via Outside of Bldg.


ROOF ROPE TIED TO STURDY OBJECT
HOSE ROLLER ROPE
2½" HOSE. - 2 LENGTHS. PULLED ON ROOF
ROLLING HITCH & BINDER

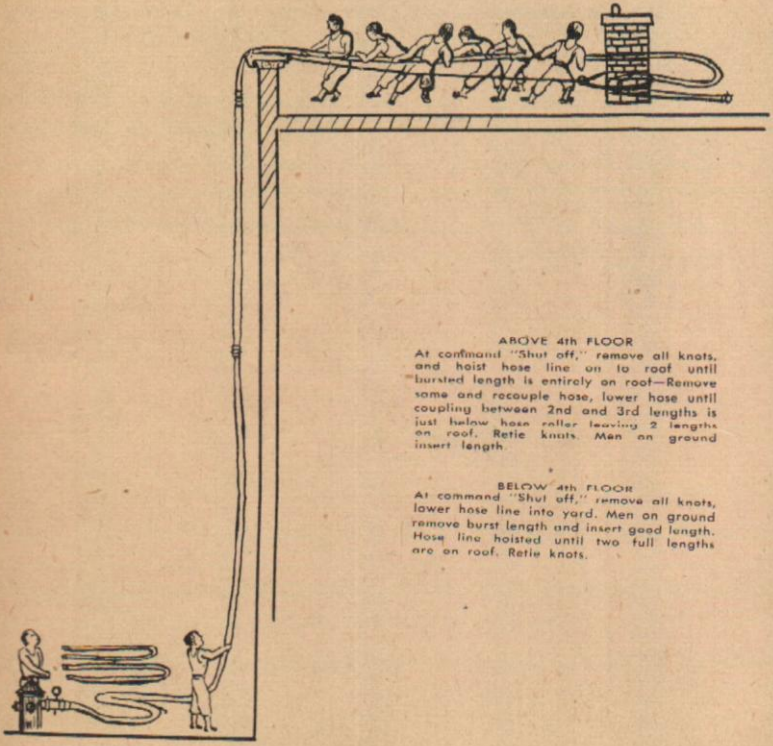


Equipment

1 Low Pressure Hydrant Wrench
6 Lengths of 2½" Hose
1 Roof Rope
1 Hose Roller
1 Open Nozzle (2½" x 1¼")
1 Controlling Nozzle (2½" x 1¼")
1 Pipe Holder (Perfection 2½")
1 Axe
1 Claw Tool
1 Lock Breaker
1 6 ft. Hook
1 Combination Punch and Chisel
1 Hose Spanner for Each Member

EVOLUTION NUMBER 2

Replacing Burst Lengths of Hose in a Line That is Stretched Up On the Outside Of a Building



ABOVE 4th FLOOR

At command "Shut off," remove all knots, and hoist hose line on to roof until bursted length is entirely on roof—Remove same and recouple hose, lower hose until coupling between 2nd and 3rd lengths is just below hose roller leaving 2 lengths on roof. Retie knots. Men on ground insert length.

BELOW 4th FLOOR

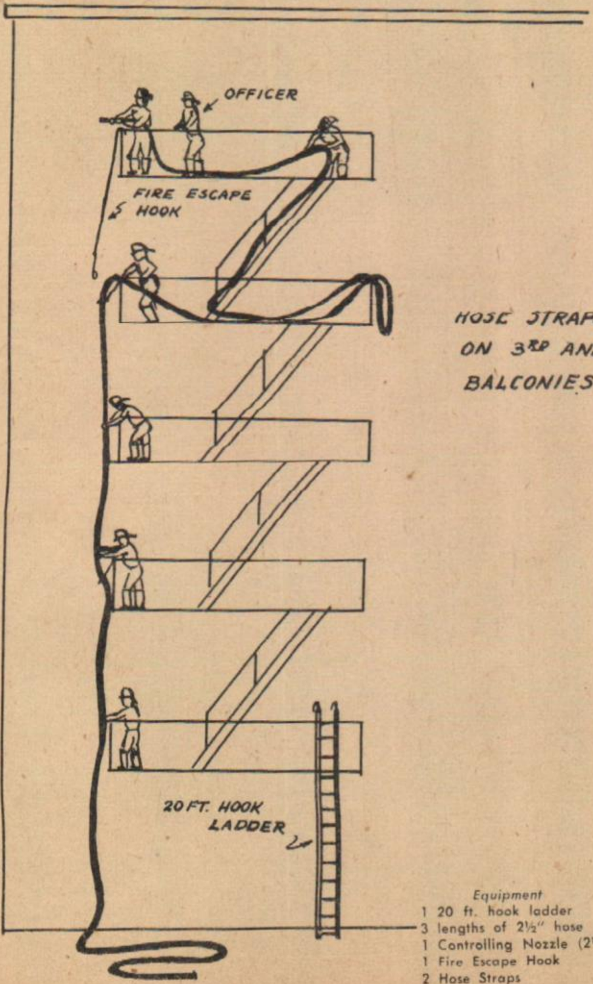
At command "Shut off," remove all knots, lower hose line into yard. Men on ground remove burst length and insert good length. Hose line hoisted until two full lengths are on roof. Retie knots.

Equipment

2 Lengths of 2½" hose in addition to the equipment used in Evolution No. 1

EVOLUTION NUMBER 3

Stretching Hose Line, Via Fire Escape

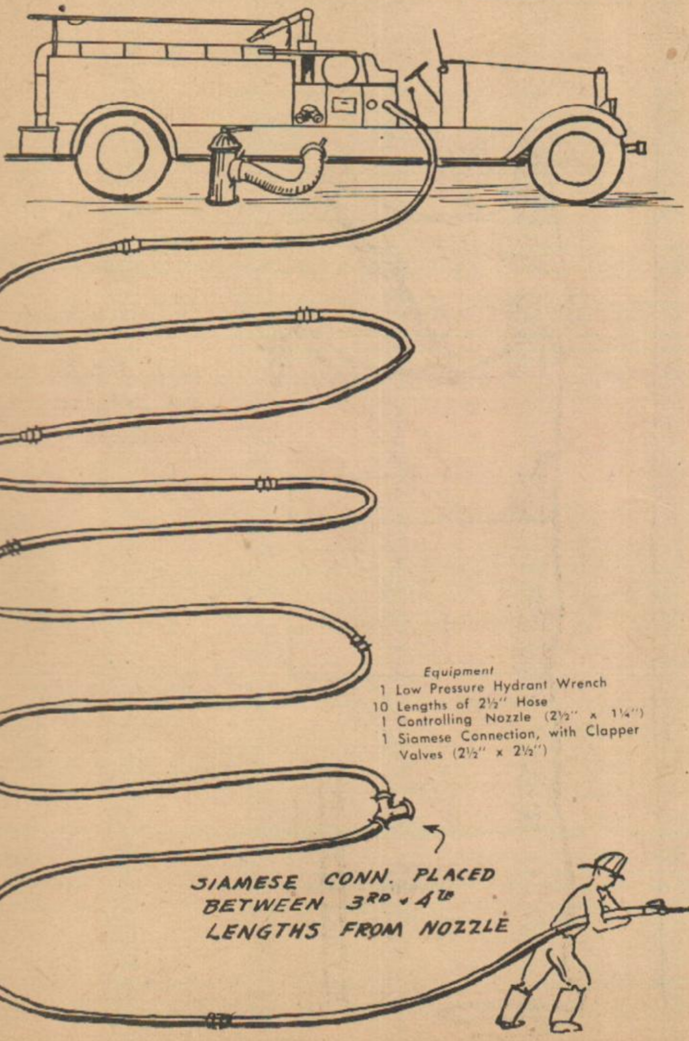

OFFICER
FIRE ESCAPE HOOK
HOSE STRAPS USED ON 3RD AND 5th FL. BALCONIES
20 FT. HOOK LADDER

Equipment

1 20 ft. hook ladder
3 lengths of 2½" hose
1 Controlling Nozzle (2½" x 1¼")
1 Fire Escape Hook
2 Hose Straps

EVOLUTION NUMBER 4

Stretching a Hose Line of Ten or More Lengths of 2½" Hose At a Third or Greater Alarm of Fire

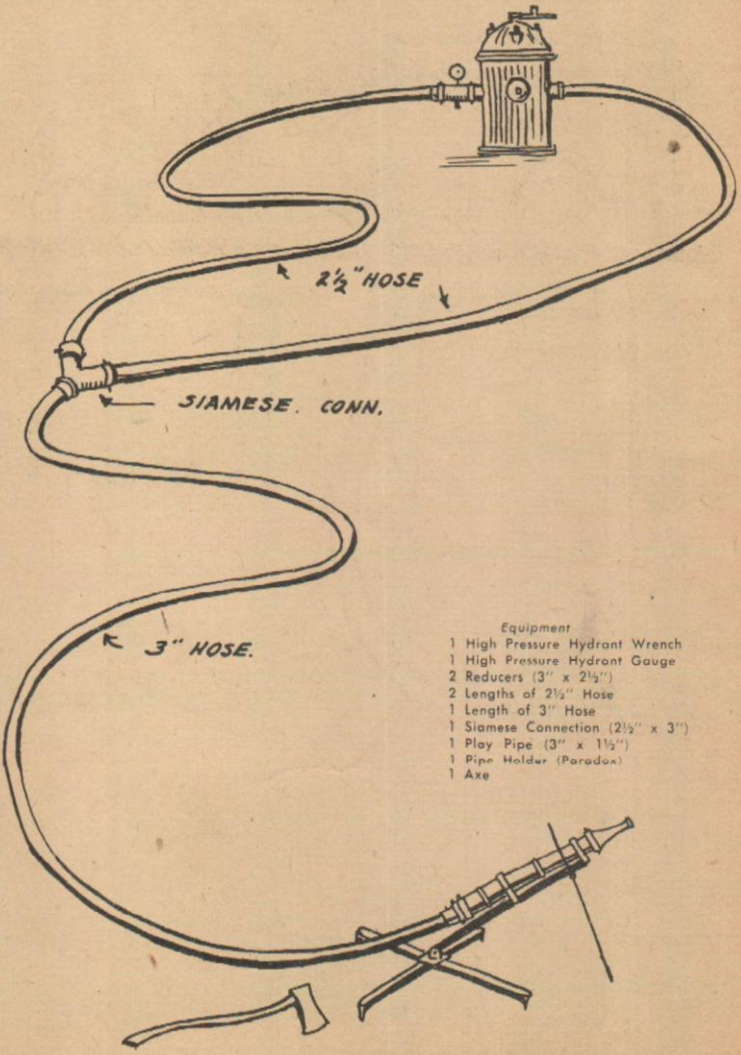


Equipment

1	Low Pressure Hydrant Wrench
10	Lengths of 2½" Hose
1	Controlling Nozzle (2½" x 1¼")
1	Siamese Connection, with Clapper Valves (2½" x 2½")

EVOLUTION NUMBER 5

Siamesing Two Lines to Develop a Heavy Stream

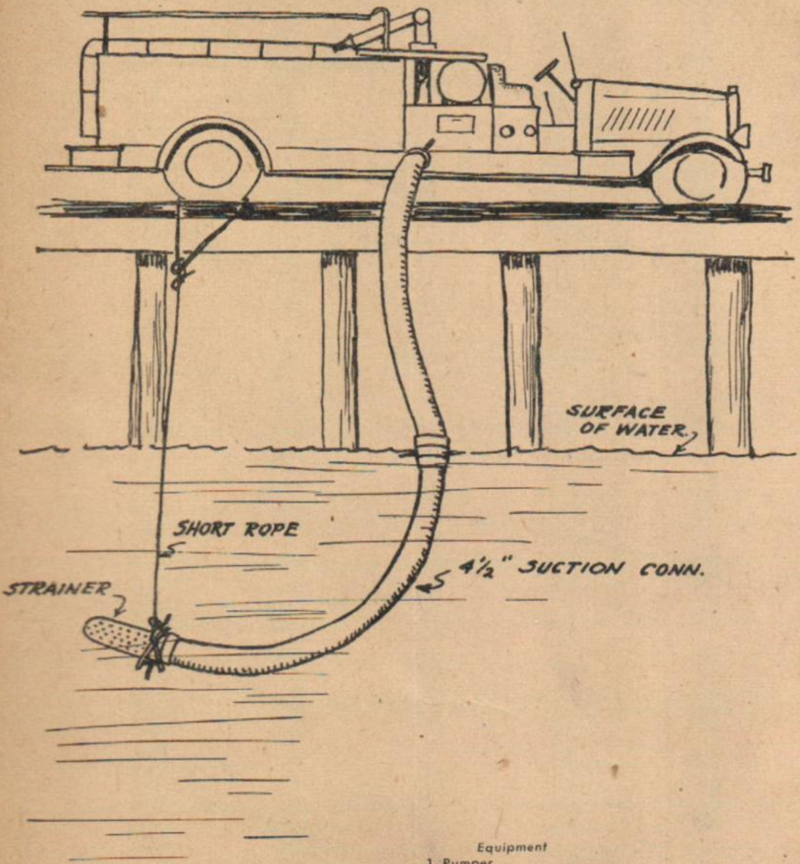


Equipment

1 High Pressure Hydrant Wrench
1 High Pressure Hydrant Gauge
2 Reducers (3" x 2½")
2 Lengths of 2½" Hose
1 Length of 3" Hose
1 Siamese Connection (2½" x 3")
1 Play Pipe (3" x 1½")
1 Pipe Holder (Paradox)
1 Axe

EVOLUTION NUMBER 6

Placing a Pumping Engine in Position to Draught Water

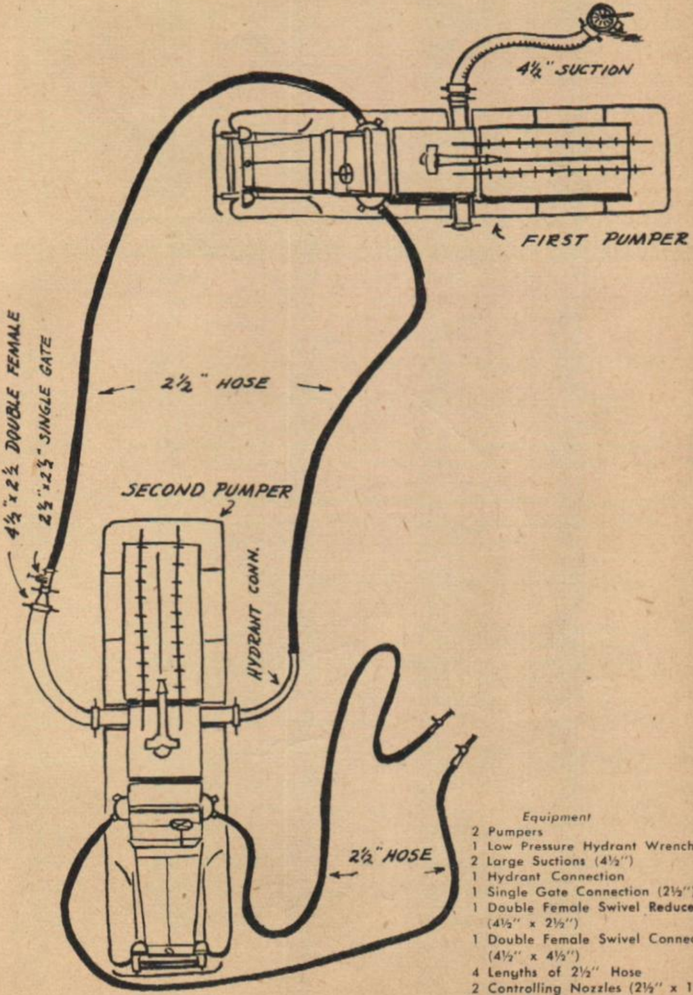


Equipment

1 Pumper
2 Large Suctions (4½")
1 Strainer
2 Large Spanners
1 Short Length of Roof Rope at least 35' long (for supporting weight of suctions and strainer)

EVOLUTION NUMBER 7

Relaying Water From One Pumping Engine to Another

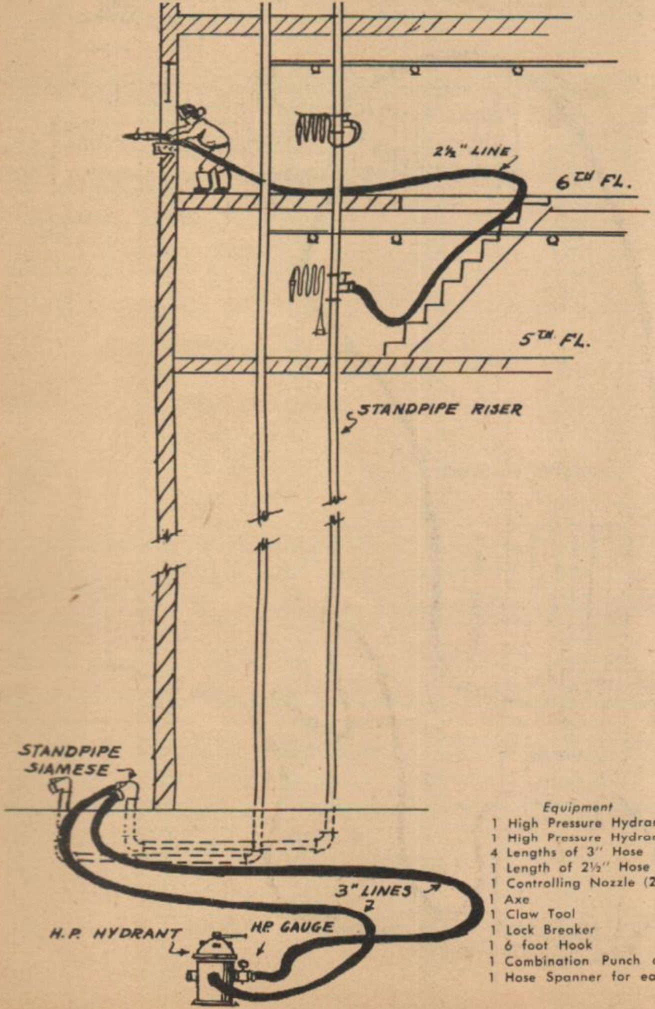


Equipment

2 Pumpers
1 Low Pressure Hydrant Wrench
2 Large Suctions (4½")
1 Hydrant Connection
1 Single Gate Connection (2½")
1 Double Female Swivel Reducer (4½" x 2½")
1 Double Female Swivel Connection (4½" x 4½")
4 Lengths of 2½" Hose
2 Controlling Nozzles (2½" x 1⅛")

EVOLUTION NUMBER 8

Supplying Water to a Standpipe System and Operating a Hose Line Therefrom

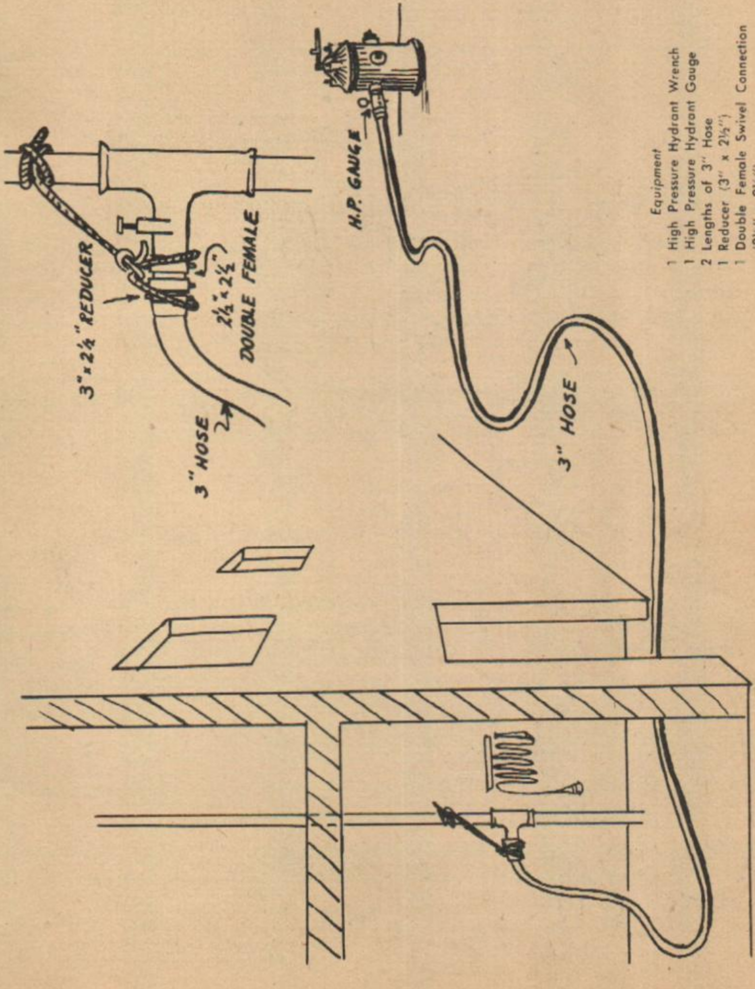


Equipment

1 High Pressure Hydrant Wrench
1 High Pressure Hydrant Gauge
4 Lengths of 3" Hose
1 Length of 2½" Hose (rolled up)
1 Controlling Nozzle (2½" x 1¼")
1 Axe
1 Claw Tool
1 Lock Breaker
1 6 foot Hook
1 Combination Punch and Chisel
1 Hose Spanner for each member

EVOLUTION NUMBER 9

Supplying Water to a Standpipe System Through Standpipe Hose Outlet Valve Inside of Building

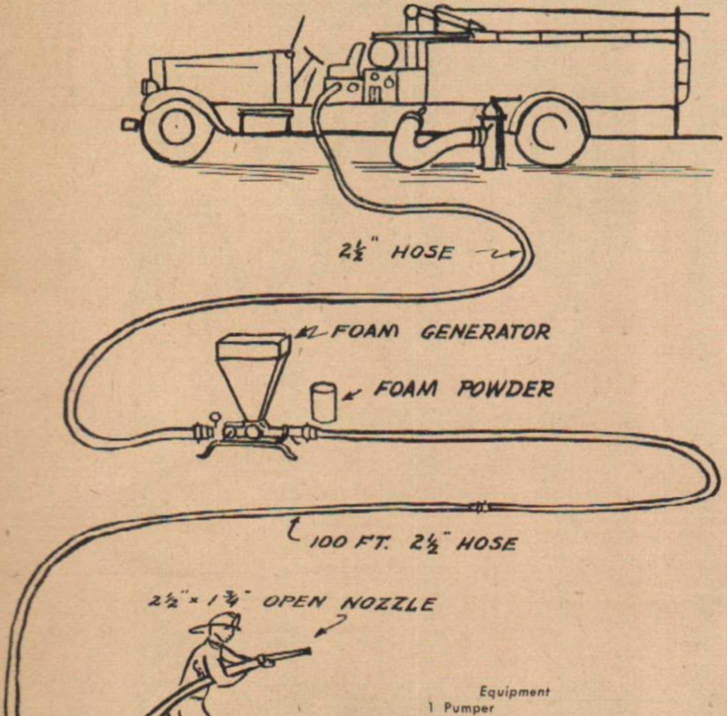


Equipment

- 1 High Pressure Hydrant Wrench
- 1 High Pressure Hydrant Gauge
- 2 Lengths of 3" Hose
- 1 Reducer (3" x 2½")
- 1 Double Female Swivel Connection (2½" x 2½")
- 1 Short Piece of ½" Rope (about 12 ft. long)
- 1 Hose Spanner for each member

EVOLUTION NUMBER 10

Supplying Water to a Foam Generator and Operating a Hose Line Therefrom

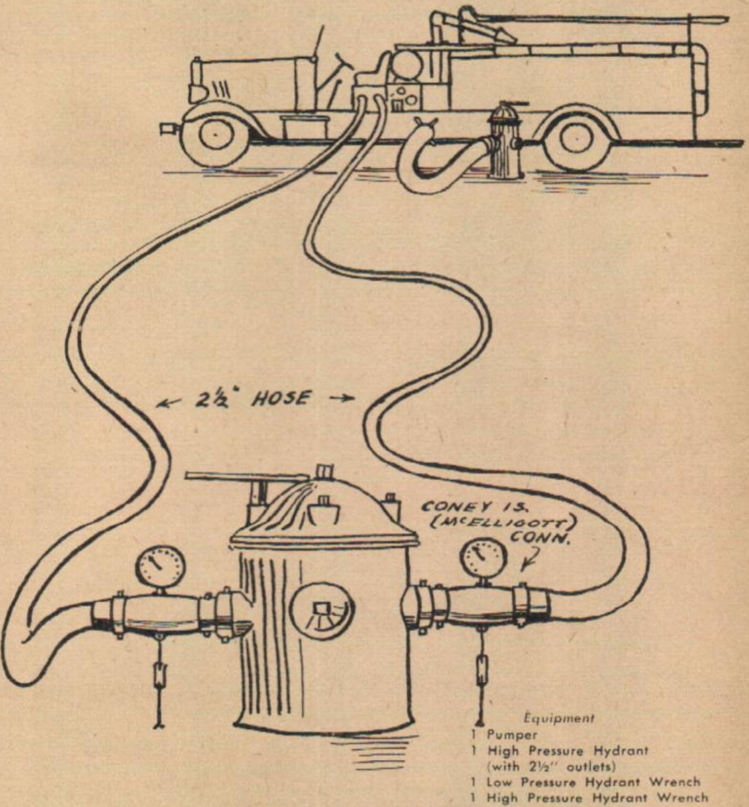


Equipment

1 Pumper
1 Low Pressure Hydrant Wrench
1 Large Suction (4½")
1 Double Female Swivel Connection (4½" x 4½")
3 Lengths of 2½" Hose
1 Open Nozzle (2½" x 1¾")
1 Foam Generator (single hopper type)
1 Can of Two-in-One Foam Powder

EVOLUTION NUMBER 11

Augmenting the High Pressure Water System From the Low Pressure System At Coney Island

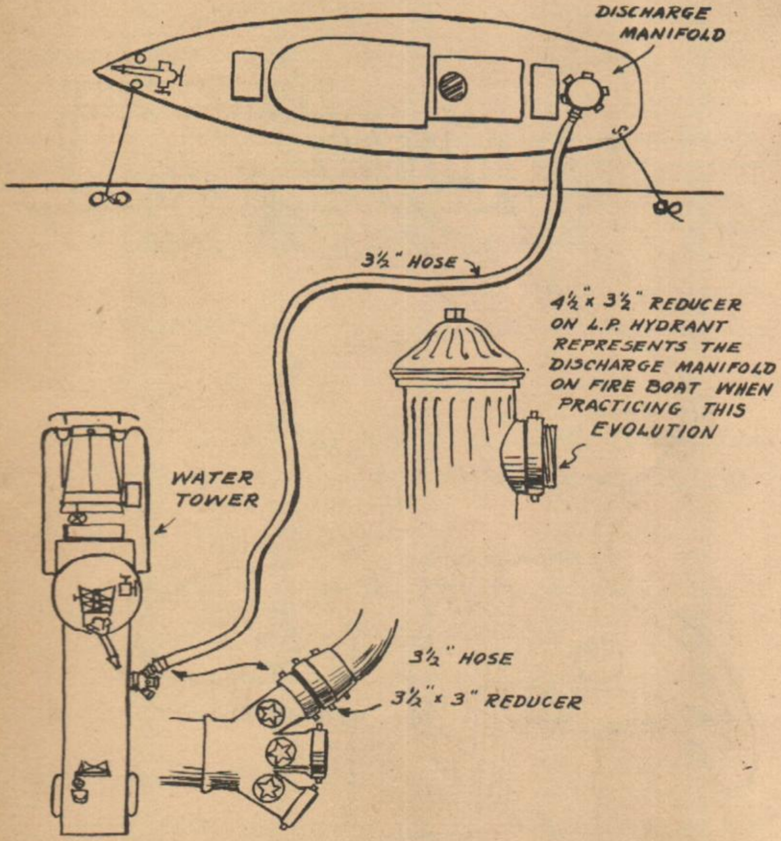


Equipment

1	Pumper
1	High Pressure Hydrant (with 2½" outlets)
1	Low Pressure Hydrant Wrench
1	High Pressure Hydrant Wrench
1	Large Suction (4½")
1	Double Female Swivel Connection (4½" x 4½")
4	Lengths of 2½" Hose
2	McElligott (Coney Island) Connections

EVOLUTION NUMBER 12

Fire Boat Supplying Water to a Water Tower

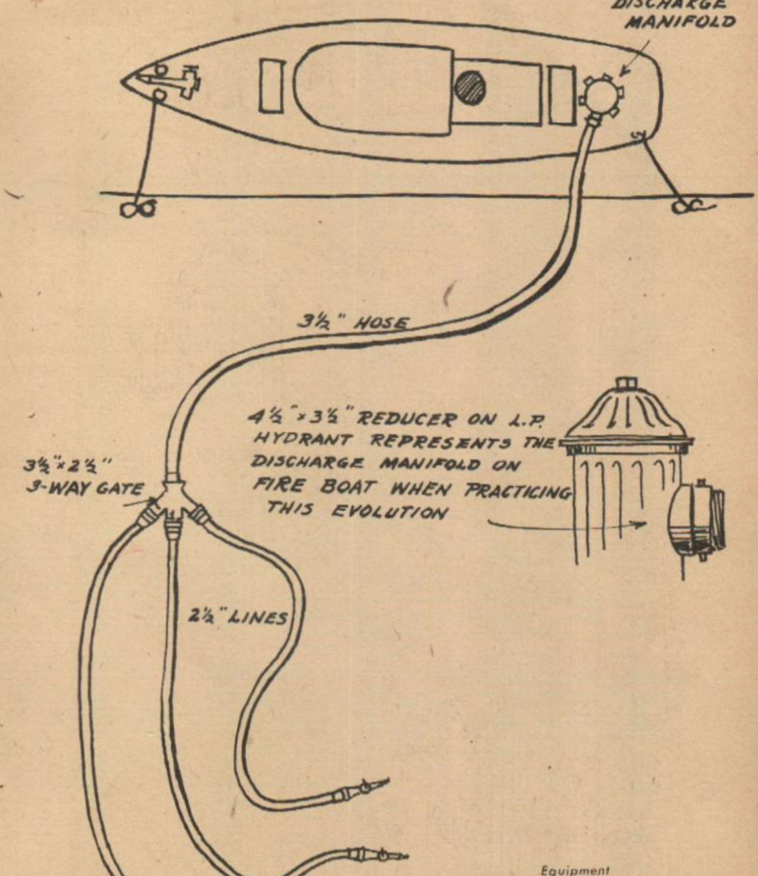

DISCHARGE MANIFOLD
3½" HOSE
4½" x 3½" REDUCER ON L.P. HYDRANT REPRESENTS THE DISCHARGE MANIFOLD ON FIRE BOAT WHEN PRACTICING THIS EVOLUTION
WATER TOWER
3½" HOSE
3½" x 3" REDUCER

Equipment

1 Fireboat
1 Water Tower
1 Length of 3½" Hose
1 Reducer (3½" x 3")

EVOLUTION NUMBER 13

Fire Boat Supplying Water to Three 2½" Hose Lines By Means of a Single 3½" Hose Line

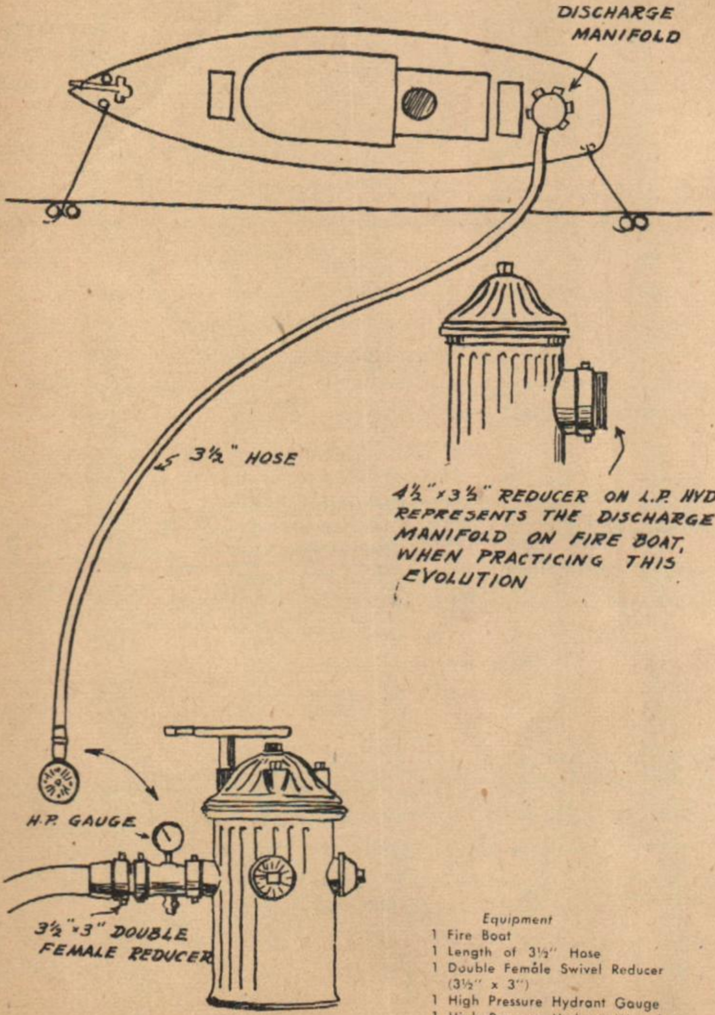

DISCHARGE MANIFOLD
3½" HOSE
4½"×3½" REDUCER ON L.P. HYDRANT REPRESENTS THE DISCHARGE MANIFOLD ON FIRE BOAT WHEN PRACTICING THIS EVOLUTION
3½"×2½" 3-WAY GATE
2½" LINES

Equipment

1 Fire Boat
1 Length of 3½" Hose
1 Three Way Gate (3½" x 2½")
3 Lengths of 2½" Hose
3 Controlling Nozzles (2½" x 1¼")

EVOLUTION NUMBER 14

Fire Boat Supplying Water to High Pressure System

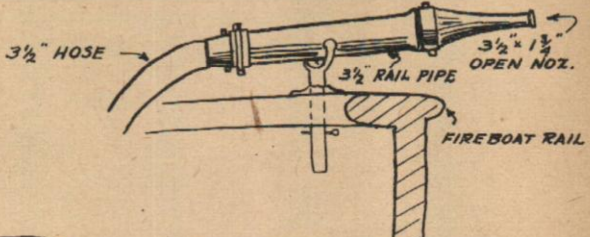

DISCHARGE MANIFOLD
3½" HOSE
4½" x 3½" REDUCER ON L.P. HYD. REPRESENTS THE DISCHARGE MANIFOLD ON FIRE BOAT, WHEN PRACTICING THIS EVOLUTION
H.P. GAUGE
3½" x 3" DOUBLE FEMALE REDUCER

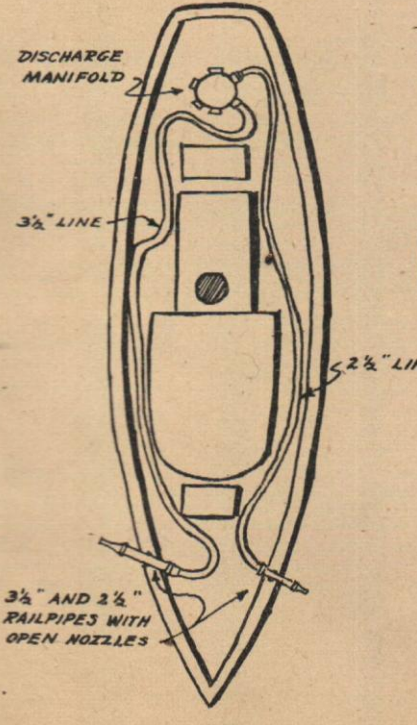
Equipment

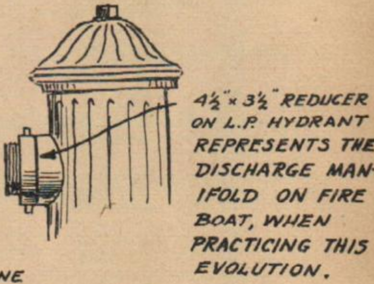
1 Fire Boat
1 Length of 3½" Hose
1 Double Female Swivel Reducer (3½" x 3")
1 High Pressure Hydrant Gauge
1 High Pressure Hydrant Wrench

EVOLUTION NUMBER 15

Operating Rail Pipes On a Fire Boat





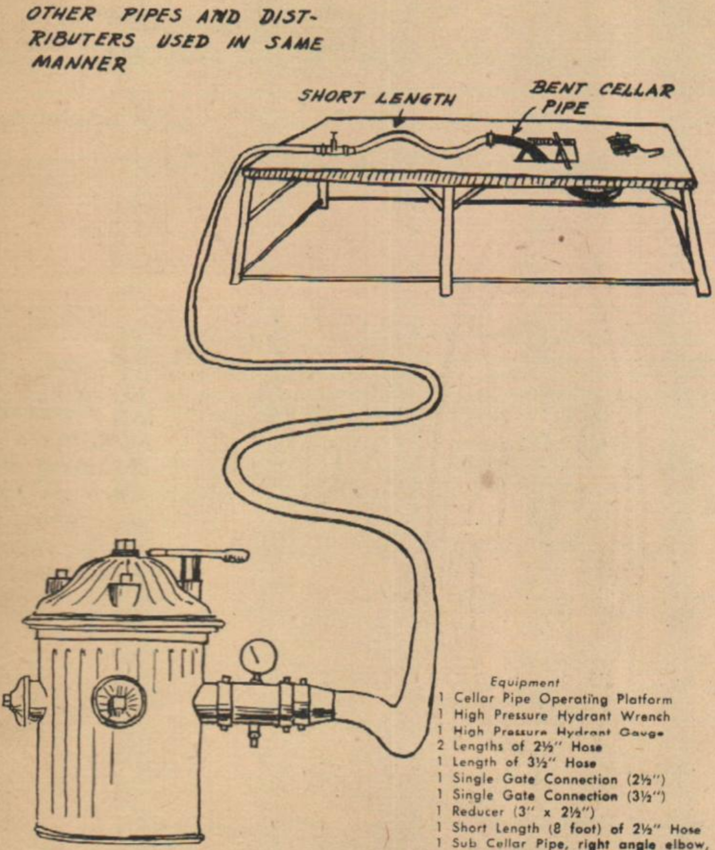

4½" × 3½" REDUCER ON L.P. HYDRANT REPRESENTS THE DISCHARGE MANIFOLD ON FIRE BOAT, WHEN PRACTICING THIS EVOLUTION.

Equipment

1 Fire Boat
1 Length of 3½" Hose
1 Length of 2½" Hose
2 Rail Pipes (3½" and 2½")
1 Open Nozzle (3½" x 1¾")
1 Open Nozzle (2½" x 1¼")

EVOLUTION NUMBER 16

Operating Sub-Cellar Pipe, Cellar Pipes and Distributors

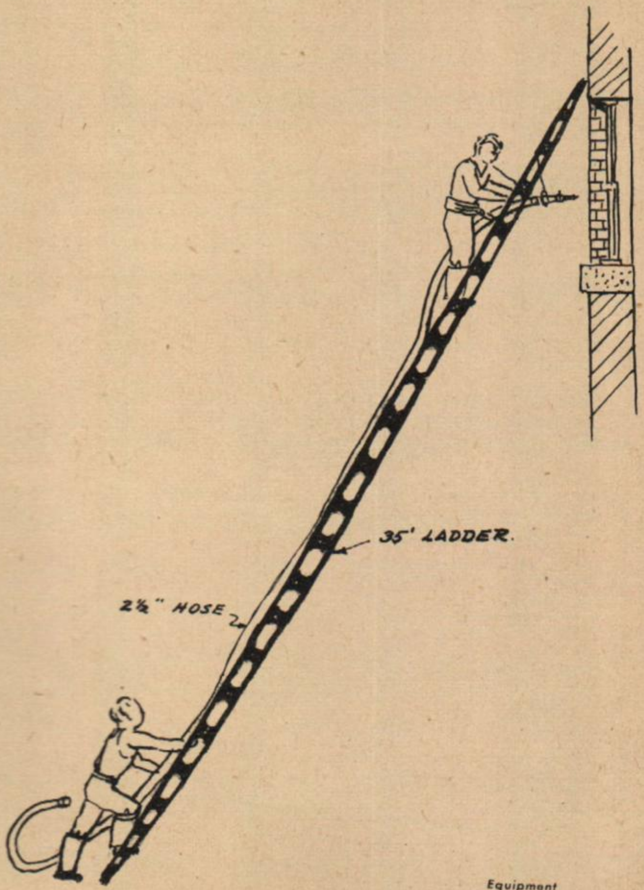

OTHER PIPES AND DISTRIBUTERS USED IN SAME MANNER
SHORT LENGTH
BENT CELLAR PIPE

Equipment

1 Cellar Pipe Operating Platform
1 High Pressure Hydrant Wrench
1 High Pressure Hydrant Gauge
2 Lengths of 2½" Hose
1 Length of 3½" Hose
1 Single Gate Connection (2½")
1 Single Gate Connection (3½")
1 Reducer (3" x 2½")
1 Short Length (8 foot) of 2½" Hose
1 Sub Cellar Pipe, right angle elbow, cross-bar, chain and toggles
1 Open Bent Nozzle (2½" x 1¼")
1 Bent Cellar Pipe
1 Baker Cellar Pipe
1 Hart Cellar Pipe
1 Bresnan Distributor
1 Bonner Distributor (spherical)
1 Heffernan Distributor (for ship fires)
1 Roof Rope

EVOLUTION NUMBER 17

Operating Hose Line From 35 Foot Ladder

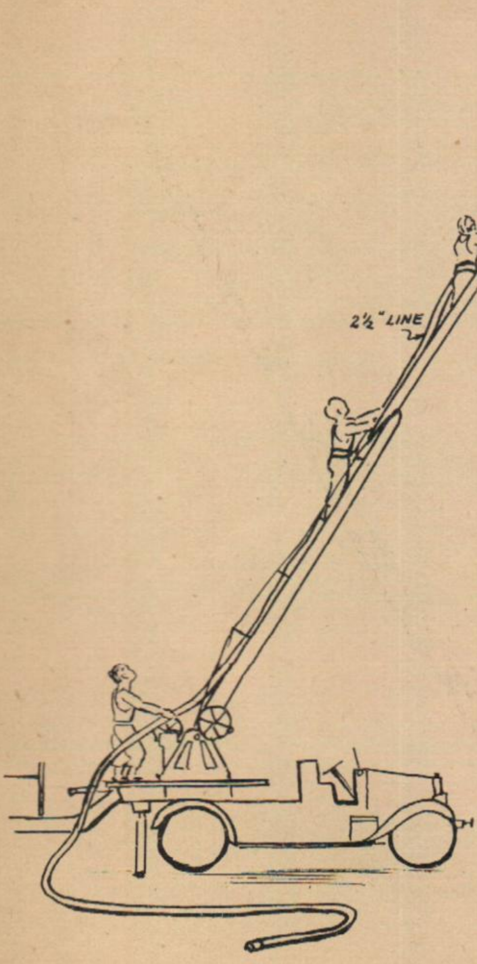


Equipment

1 35 foot Truss Ladder
1 Length of 2½" Hose
1 Controlling Nozzle (2½" x 1¼")
1 Hose Strap
1 Life Belt

EVOLUTION NUMBER 18

Operating Hose Line From Aerial Ladder

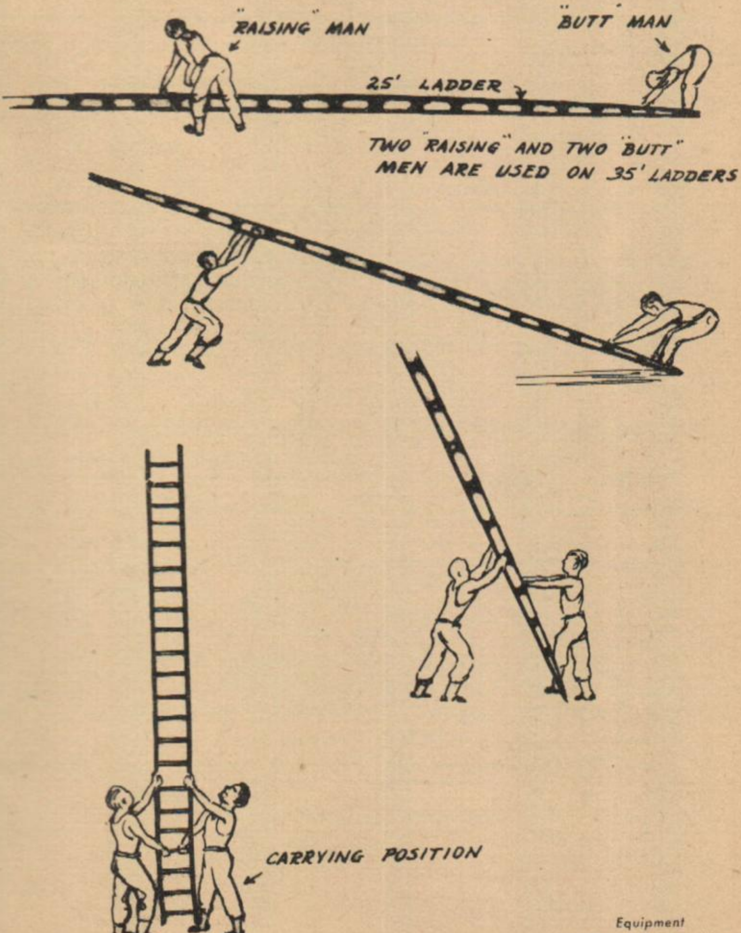


Equipment

1 75 foot Hook and Ladder Truck
2 Lengths of $2\frac{1}{2}$" Hose
1 Controlling Nozzle ($2\frac{1}{2}$" x $1\frac{1}{4}$")
3 Life Belts
2 Hose Straps

EVOLUTION NUMBER 19

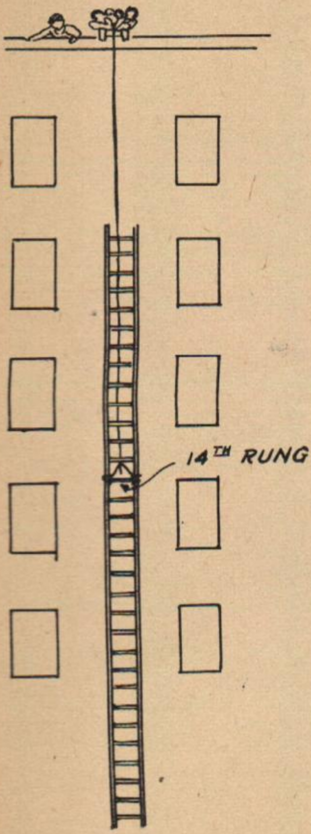
Raising, Placing, Carrying and Lowering 35 Foot and 25 Foot Ladders

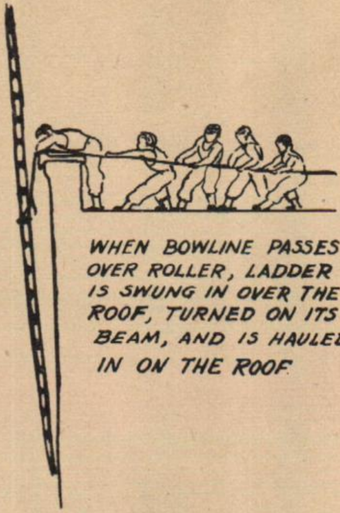


Equipment
1 35 foot Truss Ladder
1 25 foot Truss Ladder

EVOLUTION NUMBER 20

Hoisting and Lowering a 35 Foot Ladder





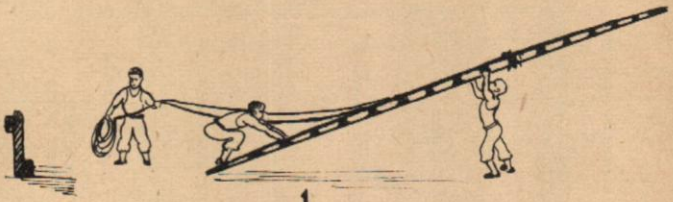
WHEN BOWLINE PASSES OVER ROLLER, LADDER IS SWUNG IN OVER THE ROOF, TURNED ON ITS BEAM, AND IS HAULED IN ON THE ROOF

Equipment

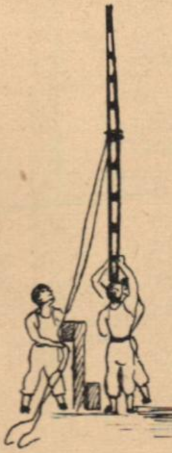
1 35 foot Ladder
1 Roof Rope
1 Ladder Roller
1 Axe
1 Claw Tool
1 Lock Tool
1 Lock Breaker
1 6 foot Hook
1 Combination Punch and Chisel

EVOLUTION NUMBER 21

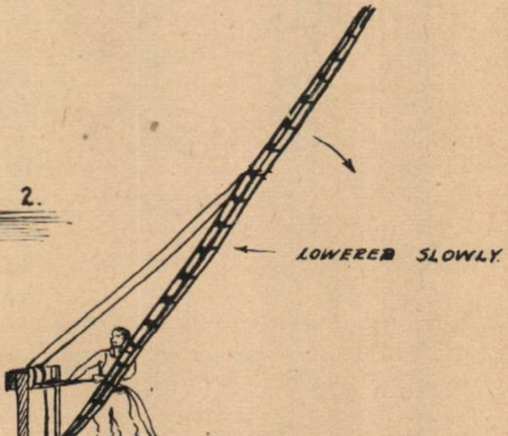
Using a 35 Foot Ladder as a Bridge



1.



2.


LOWERED SLOWLY.

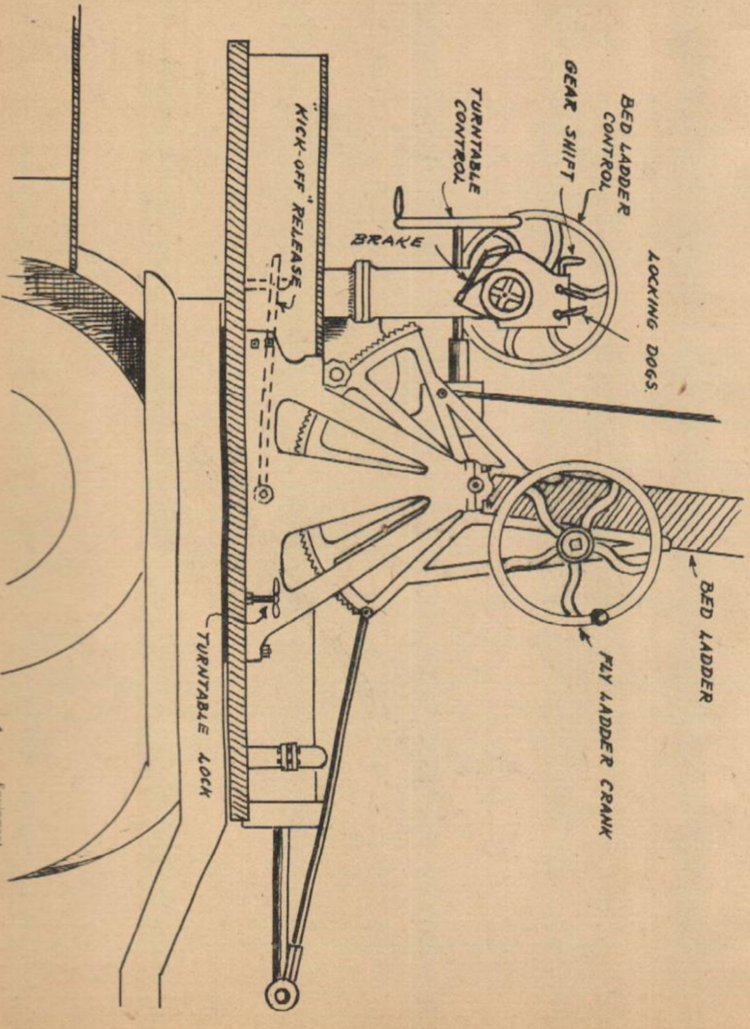
3.

Equipment

1 35 foot Truss Ladder
2 Roof Ropes

EVOLUTION NUMBER 22

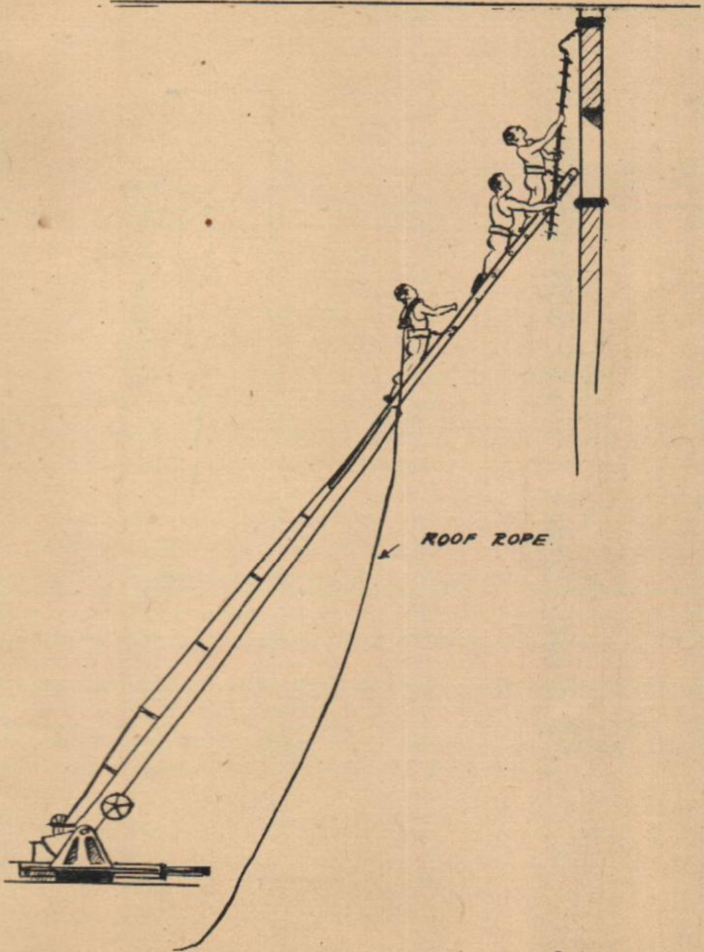
Raising and Operating Aerial Ladder



Equipment
1 75 foot Hook and Ladder Truck

EVOLUTION NUMBER 23

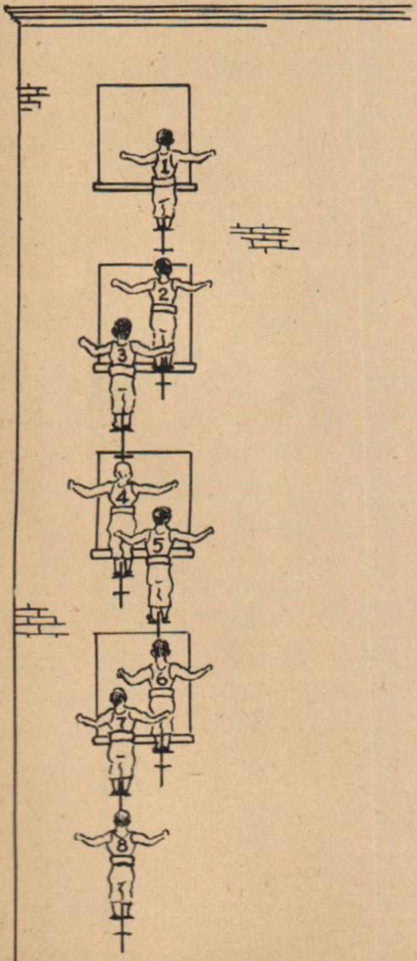
Using a Scaling Ladder in Conjunction With An Aerial Ladder

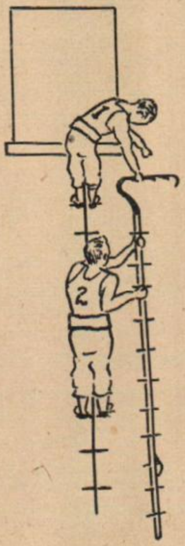


Equipment
1 75 foot Hook and Ladder Truck
1 Scaling Ladder (14 foot)
3 Life **Belts**
1 **Roof Rope**

EVOLUTION NUMBER 24

Building and Dismantling a Chain of Scaling Ladders

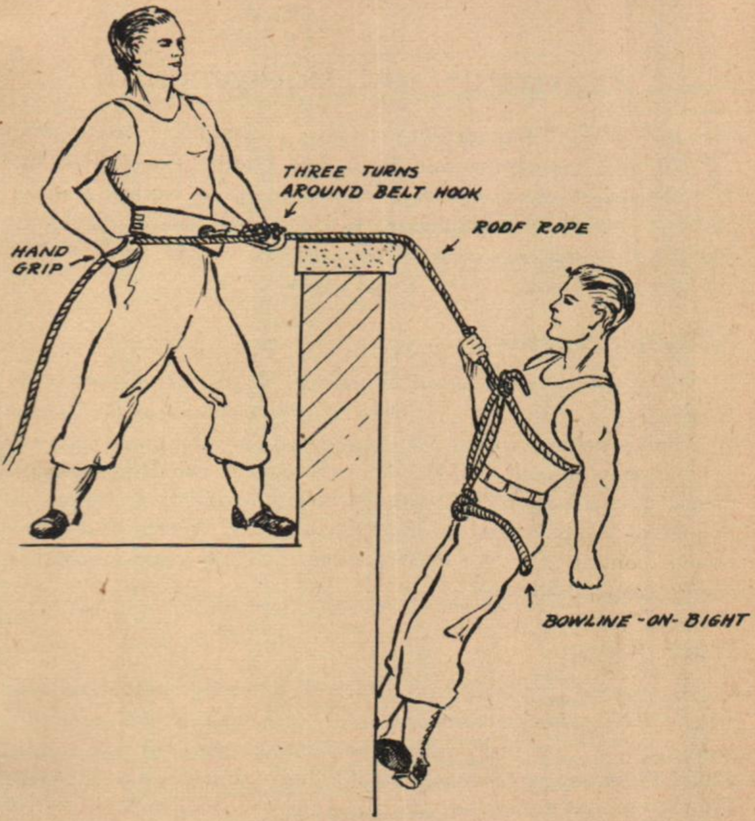




Equipment
4 Scaling Ladders
8 Life Belts

EVOLUTION NUMBER 25

Lowering or Hoisting a Person By Means of a Roof Rope



Equipment
1 Roof Rope
1 Life Belt
1 Leather Hand Grip

Apparatus and Equipment

THE FIRE SERVICE HAS TWO PRINCIPAL BRANCHES, Engine Companies and Hook and Ladder Companies. An Engine Company always has a pumping engine and, in addition, usually a hose wagon. A Hook and Ladder Company operates with but one piece of apparatus, a ladder truck which, with few exceptions, is an aerial truck.

Pumping Engine

The primary purpose of a pumper is to add pressure to the water supplied to the hose lines. This is accomplished by means of a pump housed within the apparatus. The pumping engine is so built that its rear section comprises one or two hose compartments in which may be carried, neatly folded, a supply of 1½-inch, 2½-inch and in hazardous areas, 3-inch hose. Tool closets contain nozzles, hose fittings, forcible entry tools and some rescue appliances.

Hose Wagon

An Engine Company equipped with pumping engine and hose wagon has several advantages over the Company with pumping engine only. The hose wagon permits carrying of more hose, makes for easier and quicker stretching operations and, in addition, affords the use of a deck-pipe. The deck-pipe on a hose wagon, unlike the deck-pipe on the pumping engine, which must remain stationary by the hydrant when the pumping engine is connected thereto, may be brought to any strategic position to assist the work of the hand lines in extinguishing the fire. Hose wagons also carry a supply of nozzles, hose fittings, etc.

Hook and Ladders (commonly called Trucks)

Although all of these units carry various sized portable ladders and a wide assortment of tools, pipes, fittings and a very limited supply of hose, their construction varies according to the different sections of the City. Aerial Trucks feature a long ladder, resting in two sections on top of the truck. The mechanism for raising and controlling this ladder is on a turn-table directly behind the chauffeur's seat. The Department uses aerial ladders of three lengths — 65, 75 and 85 feet. In the outlying sections "City Service Trucks", equipped with a 55-foot portable extension ladder in place of the aerial ladder, are used.

Chief's Car

Every Chief Officer, while on duty, uses a car to respond to alarms and to perform the other duties of his command. Each Chief's Car carries an All-Service Mask for immediate use when necessary. In addition, cars assigned to Deputy Chiefs of Department carry small receptacles for immersing bombs when found. The necessary oil to be used in such an operation is carried in 5-gallon cans. Many of these cars are already equipped with 1-way radio receiving sets. A concerted effort at present is being made to outfit all Chief's Cars with at least 1-way receiving sets. Two-way sets that may send, as well as receive, messages by radio are at present limited to a few cars.

Fireboats

The Marine Division of the Department consists of ten Fireboats, each classed as an Engine Company. This fleet, docked at selected points, affords fire protection to the piers and buildings along the City's 578 miles of waterfront, as well as vessels in the Harbor and adjacent water-ways. Fireboats also assist land companies in fighting fires in structures along marginal streets. Each boat has a 2-way radio hook-up, and is in constant communication with WNYF, the Department's radio station, while moored and when operating away from its berth.

An eleventh boat, "Smoke", is equipped with a small centrifugal pump and a supply of 1½-inch hose. Ordinarily it is employed in conveying men to the scene of a marine fire but it is also used to extinguish fires in places that are inaccessible to the larger boats; for example, under piers and in boats moored in shallow water.

Rescue Wagons

The four Rescue Units carry a variety of special emergency equipment: heavy jacks for raising trains, vehicles and elevators; inhalators for use in reviving persons overcome by gases and in cases of drowning; cutting torches for opening iron shutters and releasing persons trapped behind bars; masks and helmets for performing duty in gas-filled atmospheres; special keys and wrenches for shutting off the gas supply of a building, refrigeration lines and broken water mains; foam generators for use on oil and grease fires.

Water Towers

The stream from a deck-pipe will not penetrate effectively above the third story. When a fire occurs in a higher story of a building and it cannot be fought from the inside, a Water Tower is placed in operation. This apparatus, with a mast extending 65 feet above the ground, loses its effectiveness above the 8th story of an ordinary structure. Nozzles are fixed at the middle and at the top of the mast. Tower Trucks are also equipped with either one or two deck-pipes for furnishing additional heavy streams. The Department has six Water Towers in service.

Searchlights

The Department maintains four Searchlight Trucks whose special function is to illuminate the scene of a fire or other emergency occurring during darkness. These units, in addition to powerful stationary lamps, carry portable lights of varying wattage for inside work. Searchlights ordinarily respond to 2nd or greater alarms between sunset and sunrise, but may be special called to any location in the City on 1st alarms.

Smoke Ejector

This unit may be used for either drawing smoke and fumes from a building or for forcing in a supply of fresh air. Flexible hose, 12 inches in diameter, attached to gasoline motors, is used in these operations. The truck also carries foam generators, hoppers and a quantity of foam powder. The apparatus is not regularly assigned to any specific schedule of response on alarms, but may be special called to any part of the City.

Bridge Chemical Engines

The chief purpose of these units is to extinguish fires occurring on the Queensboro, Triboro and Whitestone Bridges. They are also available for other emergencies. Four such Companies are now in service, each equipped with a 270 gallon water tank connected to a pump, a foam generator, hopper and foam powder, a supply of 2½-inch and 1½-inch hose and an assortment of small fire extinguishers.

Hydrant Thawing Apparatus

Each of the 13 land divisions of the Department maintains a mobile hydrant thawing truck. Each day these trucks make routine inspections and do minor repair work on hydrants in their respective division areas. During cold weather, it is the duty of this apparatus to thaw out frozen hydrants. The necessary heat for such thawing work is generated on some of these units by gasoline and on others by fuel oil. Members operating this apparatus, during freezing weather, upon learning of a 2nd or greater alarm in the district in which they are operating, immediately respond and report to the Officer in Command. Summoned to a fire, they are employed in keeping both hydrants and apparatus in a serviceable condition. Each one of these units carries a supply of hydrant discs for attachment to unserviceable hydrants.

Under wartime conditions, when water mains may be bombed out of service, this apparatus would be the proper place to carry shut-off keys for controlling water mains, gates and valves.

Fuel Wagons

Like any other vehicle, the fuel capacity of fire apparatus is limited. In the case of a pumping engine, this fuel serves the double purpose of driving the apparatus and the pumps. Very often, then, their supply of gasoline and oil must be replenished while operating at a fire. For this purpose, the Department has three Fuel Wagons, almost identical to the ordinary gasoline delivery trucks. In addition to tanks of gas and oil, these units are equipped with safety cans for transporting the fuel to the apparatus requiring it. Fuel Wagons may be called to any location in the City, but ordinarily respond to third alarms in all Boroughs except Richmond, where they are assigned on fourth alarms.

Ambulances

One of the two Departmental Ambulances responds on all third or greater alarms, or may be special called to any box. A full supply of emergency medical equipment necessary for the treatment of burns, asphyxiation, shock and other injuries is carried on each unit. These units are, at all times, under the supervision of a Medical Officer of the Department.

Emergency Utility Unit

This apparatus features twelve small portable pumps, carried in side compartments, for use in pumping out such flooded areas as a cellar or an excavation. These pumps, fueled by a mixture of oil and gasoline, can be placed to relay water over a long distance.

Fire Service Supervising Company

The members of this unit use a spare Chief's Car to respond to the scene of a multiple alarm of fire. They supervise the operations of auxiliary fire equipment such as standpipe and sprinkler systems, as well as foam lines in oil yards, etc. They assist the operators of pumping engines, water towers, searchlight and smoke ejector apparatus, as well as all other special apparatus. This unit is divided into three groups, the first land group is assigned to duty in Manhattan, Bronx and Richmond, the second land group is assigned to Brooklyn and Queens and the third is a Marine Division group.

Airport Unit

The immense airplane traffic at LaGuardia Field, with the necessary hangars and fuel storage tanks, entails a considerable fire hazard. The Airport Unit, commonly known as the "Crash Wagon", is designed for instant action at the scene of a fire, crash or other accident at the Field. Clothed completely in asbestos suits, the crew can close in on a fire and extinguish it with a stream of carbon dioxide "snow". Usable as a tow-car, the truck is also fitted out with an array of rescue tools for releasing persons trapped in a plane.

Air Compressor Trucks

Assigned to the Bureau of Fire Alarm Telegraph, the everyday use of these two units is in drilling shallow trenches through asphalt and concrete for the laying of conduits. Its pneumatic drills and jack-hammers are used at pier fires for breaking through the concrete flooring, and at building fires in breaking through thick stone walls.

Relay Hose Apparatus

This apparatus, a redesigned 75-foot aerial ladder truck, carries 60 lengths of 3½-inch hose that will be used as a substitute for water mains made unserviceable under wartime conditions. It will also help to facilitate the laying of hose in relaying water over long distances. At the present writing there are three such units in service with the intention of installing several more.

SPECIAL APPARATUS OUTSIDE THE DEPARTMENT

Fire Insurance Patrols

The New York Board of Fire Underwriters maintains eight fire patrol companies for the protection of the stocks of merchandise of business concerns and the furnishings of homes against the damage of fire and water. For this purpose, each truck carries a large supply of canvas covers that are chemically treated to withstand water. Except in the outlying sections of the City, these units respond on first alarms. Besides their specified duties, they often assist the members of the Fire Department in stretching hose lines and in extinguishing fires.

Police Emergency Squads

The New York Police Department maintains twenty Emergency Squads subject to call to the scene of a riot, fire, accident or other emergency. Like the Fire Department Rescue Companies, these units carry several types of gas-masks, heavy jacks, blocks and tackle, and shut-off keys for gas and refrigeration systems.

Standard Oil Company Foam Truck

The Standard Oil Company of New York maintains a Foam Truck, with competent chauffeurs, at their Greenpoint Yard, for Fire Department use at any location. The truck, intended for use at extensive oil and grease fires, is equipped with three portable foam generators and 7000 pounds of foam powder. Additional powder may be obtained at the Company's plants.

Apparatus of Public Utility Companies

Such corporations as the Consolidated Edison Company maintain several emergency trucks that are often employed at fires in treating victims of asphyxiation and electric shock. These units carry inhalators, oxygen tanks, stretchers and blankets, and complete first aid kits. The air compressor trucks of these Companies, equipped with pneumatic drills, are also available for Fire Department use.

Water Department Truck

The Department of Water Supply, Gas and Electricity maintains emergency trucks for responding to multiple alarm fires. The duty of each crew is to insure the continuance of adequate water pressure in the vicinity. For this work they are equipped with the necessary wrenches and blue-prints of the lay-out of water mains and locations of gates and valves.

The three private water companies operating in Jamaica, Woodhaven and Flatbush maintain a similar service.

Sanitation Department Hose Reels

Every company in the department has at least one reel of hose borrowed from the Department of Sanitation. Each reel has a limited supply of hose, an open nozzle, hydrant wrench and necessary fittings.

Pending receipt of auxiliary apparatus these reels will furnish some degree of assistance in fire extinguishing operations.

Other Sources of Aid

In the extreme emergency resulting from an enemy air-raid on the City, the Fire Department will receive assistance from additional sources. A mutual aid agreement exists whereby the Fire Departments of adjacent cities and towns will respond to New York City. Sanitation Department flushing trucks, available for fire service on each Election Day, may also be used. Fleets of privately owned tugs, fitted with pumps and nozzles, will supplement the work of fireboats. Public Ambulances are always ready to render assistance.

Signals — Incidental Duties

THERE ARE THREE ELEMENTARY REASONS FOR A FIRE STATION. It provides a central point where firemen are assembled and may be called in case of fire or other emergency. It provides a place of shelter and housing for apparatus, tools and equipment, where such may be cleaned, fueled and made ready for instant use. Finally, it affords the men assembled there a place for drilling and preparedness in the problems they are to face.

There is little need to discuss at length the importance of discipline. American men know that in any branch of fighting, adherence to disciplinary authority, whether it be self-discipline or the vesting of authority in one man over other men, is absolutely necessary for singleness of purpose, for efficiency of operation, for ultimate victory. Fire-fighting differs little from any other form of fighting. When the responsibility for making decisions and giving orders that carry out those decisions is given to a man, it is because he is capable of handling that responsibility through training, experience, or both.

At a fire, or in quarters, there is only one boss. He is the Officer of superior rank. Whether the Officer in [illegible]mmand of your unit be a Captain, Lieutenant or Acting-Lieutenant, it is your duty to obey him without hesitancy or question. Your judgment, remember, is subordinate to his. If you were fighting with the United States Army, Navy or Marine Corps, you certainly would not think twice before complying with a given order. So it is with the fire forces. Complete discipline is essential right down to the smallest detail in the maintenance of quarters. And, incidentally, it is within quarters that discipline begins. Personal feelings and conceits must be put aside. Obey every command you receive quickly and without comment. Upon discipline of this sort our victory or failure shall rest.

Calling Men to Fires or Other Emergencies

At this time there are but three methods of summoning firemen from the fire station for fire or other emergency: the Fire Alarm Telegraph System, by means of coded signals; by use of the telephone; or by word of mouth. A disaster could render useless the Fire Alarm Telegraph wires as well as the telephone. In such event, some other means for the transmission of alarms, such as the use of radio, will be substituted. At any rate, it will be at the Fire Station that the alarm will be received and Firemen should make a close study of the method in vogue for receiving such alarms.

A Fire Alarm Box

The ordinary fire alarm is sent from a fire alarm box. A fire alarm box is a device which opens and closes an electric circuit in such a way as to transmit a coded signal. It consists of a clock mechanism, which, when set in action, causes a shaft to revolve. To this shaft is attached a code wheel that has notches cut on its edge to correspond to a box number. Resting on the code wheel is a set of contacts which are connected to a circuit. As the code wheel revolves, the contacts rise and fall, the circuit is opened and closed, thereby transmitting a signal which is received at Central Fire Alarm Station, and immediately retransmitted over the Fire Alarm Circuits.

It is necessary that every Fireman in the Fire Station, as well as the one assigned to housewatch duty, know the Department signals. Memorize these signals. Each signal carries a message that is of vital importance. It is not necessary to memorize the location of the various numbered boxes. A list of your company's response boxes will be before you in a prominent place for quick reference and absolute verification upon receipt of an alarm signal. But the table of preliminary signals and their full meanings should be studied, digested and committed to memory. Following will be found a table of Fire Department Preliminary Signals.

PRELIMINARY SIGNALS OF THE NEW YORK FIRE DEPARTMENT

2	Time Signal 12 Noon
2-2	Second Alarm
2-2-2	(a) Pay Signal
	(b) Out of Service Signal
	(c) Company stops to extinguish a fire while responding to another location.
2-2-2—65-2	Restricted use of Radio Station WNYF.
2-2-2-2	Pumper of an Engine Company.
3	Special Building Box.
3-3	Third Alarm.
3-3-3	Men Only.
3-3-3-3	Fuel Wagon.
4	Chief of Battalion.
4-4	Fourth Alarm.
4-4-4	(a) In Service Signal
	(b) Return Radio Station WNYF to normal use.
4-4-4-4	Return to 8 hour tour system.
5	Engine Company.
5-5	(a) Fifth Alarm.
	(b) Additional engines required after 5th alarm.
5-7	Engine Co., Hook & Ladder Co., and Chief of Battalion 1st Due.
5-5-5	Sappers and Miners.
5-5-5-5	Display National Standard at Half Mast; turn on radio in Company Quarters and tune in 1630 K.C.
6	(a) Hose Wagon.

	(b) Terminals 101-102-103, etc.—Relay Hose Apparatus.
6-5-2	Turn on radio in Company Quarters and tune in 1630 kc. (1.63 mc.)
6-6	(a) Borough Call—Manhattan and Bronx. (b) Notification Signal for Manhattan and Bronx alarms.
6-6-6	Department Ambulance—Manhattan & Bronx 1 —Queens and Brooklyn 2.
6-6-6-6	Establishment of 16 hour tour system.
6-6-6-6-6	Establishment of continuous duty system.
7	Hook and Ladder Company.
7-4	First Due Hook and Ladder Company and Battalion Chief to respond to household refrigeration leak.
7-7	(a) Borough Call—Brooklyn and Queens. (b) Notification Signal for Brooklyn and Queens alarms.
7-7-7	Public Ambulance.
8	Increase, reduce or shut down pressure on High Pressure System.
8-8	(a) Borough Call—Richmond. (b) Notification Signal for Richmond alarms.
9	Water Tower.
9	Terminal 41—Smoke Ejector and Foam Truck.
9	Terminal 51—Man., Bx. and Richmond Unit Supervising Engineers.
9	Terminal 52—Bklyn. and Queens Unit Supervising Engineers.
9	Terminal 53—Marine Unit Supervising Engineers.
9	Terminal 61-62-63-64—Bridge Chemical Engine Company.
9-9	Simultaneous Call.

9-9-9	Restoration of High Pressure System after a breakdown.
10	Rescue Company.
10-10	Police Emergency Squad.
10-10-10	Emergency assignments and regulations.
11	Telegraph Test.
12	Fire Patrol.
12-12	Police Riot Call.
12-12-12	Return to regular assignments and regulations.
13	(a) Breakdown of apparatus while responding to an alarm. (b) Unable to leave quarters in response to an alarm.
13-3-13	Sound Air Raid Warning.
13-4-13	All Clear. Emergency Responses. Raid is over.
13-13	Breakdown of High Pressure System.
13-13-13	Telegraph Emergency Squad.
14	Relocation of Chief of Battalion.
14-14	Mutual Aid.
15	Relocation of Engine Company.
15-15	Relocation of Pumper.
16	Relocation of Hose Wagon of an Engine Company.
17	Relocation of Hook and Ladder Company.
18	Searchlight Apparatus.
19	Highways, Bridges and Ferries.

MORSE KEY SIGNALS

2-3	Acknowledgment of receipt of signal.
2-9	Fireboat return to berth.
3	Repeat, I do not understand.
3-3-3	Repeat last station transmitted.
6-5	(a) When received at a street box, go to a telephone and call dispatcher. (b) When received on Morse Key on combination instrument, preceded by the company

Box Number

Location

Deputy Chief

Chief of Battalion

Gas + Oil Wagon

High Pressure Zone

601	ELEVENTH AVENUE AND 22ND STREET	MANHATTAN H. P.

	ENGINE CO'S	Boat	Res Co	H & L Co's	D.C.	CofB	W.T.	GOW	Res CofB	COMPANIES TO CHANGE LOCATION		
										ENGINE		H. & L.
First alarm	3 19 34 1	86		12 21		7 6			5			
Second alarm	2 18 14 24 26	85	1	5	2		3			47–2 76–3	7–18 56–1	22–21 1–5
Third alarm	72 16 30 54 5	57		24		9		1		91–16 44–5	32–30	20–24
Fourth alarm	33 13 65 27 25 20			3		3				53–65	15–33	18–3
Fifth alarm	40 29 28 21 55 31			7						10–29	203–31	

12-27-40 400

22 Truck locates in quarters of 21 Truck etc.

Rescue Co.

Water Tower

Eng Co. 10 locates in quarters of Eng Co 29 etc.

number, the company shall call dispatcher on telephone.

(c) When received at the Central Office followed by the company number, the Dispatcher shall call company on the telephone.

7-5 Full 1st Alarm assignment required.

9-2 Malicious False Alarm.

Few of the signals listed constitute a complete signal. They are merely preliminaries, that is, they begin a signal. They answer the query "What?" in the triple question—"What—Where—Who" associated with most signals. For example, the signal 5-1262-53 answers the three questions as follows: What?—An Engine Company; Where?—Box 1262; Who?—Engine Company Number 53.

A knowledge of the preliminaries, therefore, is only a step, although a big one, towards the understanding of the entire subject of signals. Consult an up-to-date revision of General Order No. 1, of January 1st, 1936, for a complete explanation of this topic.

Housewatch Duty

Firemen are assigned to Housewatch Duty in a Fire Station just as soldiers are assigned to sentry duty in a regiment. Under normal conditions, Housewatch Duty is assigned to firemen in specified periods, usually of four hours duration. But no matter what the duration of your assignment to such duty may be, your responsibility is definite and important. You are responsible for receiving and recording alarms. You must turn the Company out upon receipt of an alarm to which your unit is assigned. You are the point of contact between the public and the fire forces. And, incidentally, it may be a very frightened and unbalanced public at that, making tact, calmness and patience on your part, very valuable assets. Don't let anything excite you. Listen to the alarm signal, record it as you hear it with chalk on a black-board, determine quickly but surely, by consulting the assignment cards, if the signal affects your unit, and if it does, call the location out in clear tones. If the call for response comes over the telephone, follow the same procedure; repeat the message to the Dispatcher, to be sure there is no mistake, then let the Officer and men of your unit know in no uncertain fashion where they are to respond.

As you may have already observed, it is not only on telegraph signals over the bells that companies respond. A civilian may report to your station, breathless, with news of a fire in the vicinity. Get the exact location and the content of his or her message straight. Summon your Officer and men with the still alarm button provided at the housewatch desk. Call out the address to which they are to go, and then, as in all cases of alarm, take a position in front of quarters to warn traffic and pedestrians and clear the way for quick response.

The book-keeping and record-keeping included in housewatch duty should be performed neatly and with care. Analyze the job of housewatch duty just as you would if it were a clerkship and your livelihood depended upon your efficiency. Perhaps far more than your livelihood will depend on your level-headedness and accuracy. The lives of all in the community which you are to protect may depend upon your handling of this job.

Care of Apparatus and Equipment

The care given to apparatus and equipment while in quarters is going to be the governing point by which its efficiency at fires will be measured. Every item assigned to your unit, from the smallest hand lantern to the apparatus itself, should be kept in constant readiness for use. If it becomes damaged in any way, make every attempt to repair it and render it again serviceable. If its repair is beyond first-aid skill, the Officer will summon whatever means of repair service is needed. In normal times, repair work of this sort is handled by the Division of Apparatus, and in all probability, the functioning of that Division will continue through any period of emergency. But by diligent care of apparatus and equipment, accidents excluded, you help make your Company an alert, ready-for-action unit, capable of taking the implements assigned to them, and using them to the greatest degree of proficiency. This table of rules, if followed implicitly, will make for efficiency:

1. The apparatus should be well fueled at all times.
2. It should be properly supplied with oil, grease and water.
3. Examine all bolts, spring clips, shackles, brakes, steering arms, batteries and lights.
4. Remember that a quick response will depend upon a well-charged battery; recharge it when necessary.
5. If your tires are pneumatic, they should be neither over-inflated nor under-inflated.
6. Pumps should be properly drained and, if they have employed salt water, properly flushed.
7. The sediment bulb and gas lines should be cleaned frequently.
8. Lubricate all parts subject to friction wear.
9. Test motors frequently, but do not run them unnecessarily.
10. Pump levers should not be in pumping position until such time as the pump is to be used.
11. Learn the usage of the Churn Valve and Relief Valve on your pumper and keep these valves in proper position.
12. Examine spark plugs frequently, replace if necessary.
13. If necessary, the apparatus should be supplied with an anti-freeze solution in cold weather.
14. Do not tinker with the carburetor and other intricate devices unless, due to previous automotive-mechanic experience, you have been assigned by your Officer to the specific duties of caring for such mechanical parts of your apparatus.
15. Keep the apparatus spick and span; clean it thoroughly after every run, if possible. Never use gasoline for cleaning.
16. Keep every tool, implement or device assigned to your unit in its proper place on the apparatus; keep them

clean, serviceable and lubricated, should oil contribute to their efficiency.

17. Test Life Belts and Life Nets frequently.
18. Handle gasoline carefully in re-fueling.
19. Use skid-chains when the streets are covered with ice or snow.
20. Hand extinguishers, carried on apparatus, should be at all times properly charged and ready for use.

Care of Hose

1. Hose should be kept on the apparatus dry, securely coupled and arranged in orderly fashion.
2. Hose that has been used at a fire should be flushed, scrubbed, hung to dry and replaced on the apparatus with clean, dry hose.
3. When placing hose on the apparatus, couplings should be examined and given a light oiling and fitted with proper washers.
4. Hose should be coupled tight enough to prevent leakage and arranged to avoid the use of old bends.
5. Particular care in cleaning should be exercised with hose that has been used with salt water or that has been exposed to chemicals.
6. Hose should be hung in the Hose Tower by the male coupling or placed neatly on Hose Racks, if this method is provided, and a circulation of air afforded.
7. Pump Operators should guard hose from friction damage against curbstones, etc.
8. At least two rolled-up lengths of hose should be carried on each piece of apparatus for standpipe work.
9. To insure against bursting at a fire, hose that appears to be of doubtful durability should be tested under pressure.
10. Hose should not be folded when frozen.
11. Hose lines should never be driven over unless absolutely necessary.

12. Care should be exercised to see that gasoline and oil does *not come in contact with hose.*
13. Hose Tags should be kept in a handy place on apparatus for use with hose lines.
14. Warning lanterns should be available on the apparatus for use when lines are stretched across thoroughfares or railroad tracks at night.

Care of Ladders

Care of Ladders lies chiefly in their inspection as to suitability for proper and safe use. Cables on Hook and Ladder trucks should be examined frequently and lubricated with raw linseed oil. All Ladders must be inspected periodically and whenever necessary. Ladders should be re-varnished (not painted) as a means of preserving their strength.

In making inspections of Ladders, check up for cracked or splintered beams and trusses, cracked or marred rungs, especially those to which the fly-ladder of an aerial ladder has been locked. Ladders should be scrutinized for evidence of charring and for splintered and worn rungs, particularly at points to which they are attached to the beams. Other points to consider are: spurs worn smooth from raising the ladder on pavements; breaks, splits or weakening of the guides, braces and other wooden members; tie rods loosened or unbolted.

All Ladders should be carried on the apparatus in such a position that they may be easily removed and put to instant use.

Care of Hydrants

The efficiency of an Engine Company in getting water on a fire depends upon the usefulness of the hydrant which is its source of supply. For that reason, fire hydrants should be inspected periodically—daily in cold weather. Water that has remained or accumulated through leakage in the barrel of a hydrant is bound to freeze when the temperature dips below 32 degrees, and a hydrant that is clogged with ice is as useless as no hydrant at all. Every fireman should be acquainted with the physical make-up of a hydrant. There are different types of fire hydrants, with varying characteristics, but the hydrants in any one particular district are usually uniform.

A Low Pressure Hydrant (Figs. 84 and 85)

The ordinary Low Pressure Hydrant externally presents the following objects to view:

1. The barrel or main body of the hydrant.
2. 2½-inch Outlet Butt fitted with cap and chain.
3. 4½-inch Outlet Butt fitted with cap and chain.
4. The Bonnet, which covers the upper end of the Barrel.
5. Operating Nut, to which the Hydrant Wrench is attached when opening the hydrant for discharge.

Its inner mechanism comprises a complex assembly of piping, nuts, bolts, pins, springs, gaskets, rods, etc. A minute study of all of these minor details is not essential. It would be well, however, if each new Fireman possesses a general knowledge of its most important features.

To the Operating Nut, which protrudes at the top of the hydrant, is connected the Main Valve Rod of Stem. By turning the Operating Nut, a leather seated valve, similar to the valve which controls an ordinary faucet, descends to the base of the hydrant, thereby creating an opening which permits the rush of water from the main into the barrel and out of the uncapped outlet or outlets. The upper part of the Main Valve Rod is sometimes referred to as the Spindle, and is equipped with packing to prevent entrance of water into the Bonnet. When the Hydrant Disc Valve is unseated, a valve known as the Drip Valve is automatically closed. When the hydrant is shut down after use by turning the Operating Nut, this Drip Valve is opened and the hydrant should drain.

Between the hydrant and the supply main, a 6-inch Gate Valve is provided, usually 3 or 4 feet from the hydrant, so that all connection between the hydrant and the main may be discontinued should a serious defect or emergency present itself.

The principal defects that a Fireman should note if assigned to inspect a hydrant are herewith listed in question form:

1. Is the hydrant frozen?
2. Does turning the operating nut produce a flow of water into the hydrant, or is water shut off?
3. Is it, by chance a new hydrant, with no proper connection, as yet, to the main?
4. Is the barrel or the bonnet broken?
5. Is the spindle assembly defective?
6. Are either of the butts or outlets burred, bent or defective in any way?
7. Are there any obstructions in the barrel?
8. Are caps and chains attached to the outlets?
9. Is the drain rod assembly defective; does the hydrant take considerable time to drain; does it drain at all?
10. Are there any leaks at all about the hydrant?
11. Are either of the cap nuts defective or burred, making removal difficult or impossible?
12. Is the operating nut burred, broken or missing?

If a hydrant is found defective in any way by the inspecting Fireman, report the defects to your Officer. He will have the Department of Water Supply fix it. If the hydrant is filled with water, use the Hydrant Pump to rid the barrel of water so that freezing will not occur, then make an attempt to determine why that water did accumulate. If the drain is defective, report that fact.

If the hydrant is found completely unserviceable, place a hydrant disc on it so that a Company reporting in for a fire in that area will not choose it and expect to get water. The disc is fitted with a hole at its center that permits attachment to the 2½-inch butt of the hydrant. On a High Pressure Hydrant, the use of discs varies slightly from their use on Low Pressure Hydrants. If but one or two of the independent valve outlets of the High Pressure Hydrant are unserviceable, the disc is placed on the defective outlet butt. If three or four outlets are inoperative, the High Pressure Hydrant is deemed completely out of service and a disc with a painted stripe is affixed to the outlet nearest the roadway.

Inoperative hydrants should be reported not only to the Department of Water Supply, but to your Battalion Chief as well, so that other Companies may be apprised.

The water mains in the Company's district, their diameters and pressures, should be a subject of study for Firemen assigned to that unit. The importance of attaching the pumping engine to a hydrant on a good-sized main cannot be too strongly emphasized. Try to obtain a chart of mains in the Company's district, showing how they are cross-connected; a complete inspectional survey of the hydrants in the district will acquaint a man with the size of the mains from which they draw water, for every hydrant in the City is painted with a numeral indicating the main's diameter.

Drills, Etc.

The Fire Station is the ideal spot for conducting drills, that is, "skull practice" for members. Your Officer has been to fires of every description, and when he conducts a drill session, every man should be not only alert, but eager for the information that he will impart. A soldier does not wait 'til he reaches the battlefield before he learns how to operate a gun. Nor does a good fireman wait until he encounters a situation before he gives it any thought. Fires of every nature should be discussed and analyzed; hazards listed and means of circumventing them gone over. Every phase in the operation of the apparatus should be made familiar to all members, not at fires, but in the Fire Stations, before alarms are received. The Commanding Officer should impart instructions on Building Inspection duties, the orders for which are too voluminous for treatment in this manual.

The best method of practicing the actions necessary at all types of fires is by drilling in the Evolutions, as outlined in Chapter III. In addition to discussions of fire-fighting situations, drills should include study into such related fields as Water Supply, First Aid and Knots.

Response To Alarms

EXISTING DEPARTMENTAL ORDERS PROVIDE TWO DISTINCT SETS of regulations governing the response of apparatus to alarms. First, the ordinary regulations, as outlined in General Order No. 1 of 1936, are intended to provide adequate protection for any contingency that may occur during peacetime and make reasonable allowances for the unexpected. Secondly, the emergency responses, contained in Supplement 15 of General Order No. 79 of 1941, are designed for use in wartime when, it is anticipated, enemy action may increase the number and intensity of fires far beyond the worst that could be expected in peacetime and thereby necessitate a reduction in the number of units that may be assigned to each fire. Each set of regulations will be briefly discussed.

Ordinary Regulations

The number of companies and units to respond or to change location upon receipt of an alarm, up to and including a 5th alarm, is governed by the printed Assignment Card. It is very necessary that every Fireman become acquainted with the general make-up of the Assignment Card, so that when an alarm is received on the bells, reference to it will immediately disclose whether or not his unit is to respond or change location. Two or three Engine Companies, two Hook and Ladder Companies and a Battalion Chief, as a rule, are assigned to respond upon receipt of an alarm from a street alarm box. An Engine Company that consists of two pieces of apparatus, a pumper and a hose wagon, responds as a single unit, except in the High Pressure zones, where recent orders provide that in the interest of conserving gasoline, the pumper of an Engine Company that is also equipped with a Hose Wagon, shall not respond to manually operated Special Building alarms nor to regular street box alarms within the High Pressure districts.

On a first alarm assignment, Engine Companies are either 1st due, 2nd due, 3rd due or perhaps 4th due (if 4 Engine Companies are to respond), dependent upon the distance of their quarters from the location of the alarm box. Hook and Ladder Companies are either 1st due or 2nd due. In some sections only one such unit responds.

It is the duty of the housewatchman, when an alarm is received over the bells, to determine by use of the Assignment Card, if his Company is assigned to "roll", and, if it is, to let the Officer and men know just how they are due at the location. It is the duty of the Officer in Command to verify this before responding.

Under normal conditions, but one slight variation in the use of Assignment Cards exists, and that is in recognition of the more serious nature of fires during the night. It provides that during the hours from 8 A.M. to 6 P.M., where three or more land Engine Companies are assigned, the land Engine Company last due on an assignment, unless the assignment is a Class 3 Special Building Box and the location is a school, hospital, theatre or asylum, be relieved from responding on the first alarm, but shall respond first due on the second alarm. During the night, that is from 6 P.M. until 8 A.M., all assigned Companies and units respond. But during the day, from 8 A.M. to 6 P.M., as pointed out, if your Company is a land Engine Company, and the alarm received is not one of the sort referred to above, it does not roll, if last due.

Emergency Regulations

At the outset, it must be emphasized that these regulations do not replace the ordinary assignments during the entire duration of the War. They are temporary orders and become effective only during unpredictable periods of unusual fire conditions resulting from actual war emergencies. Following are the fundamental steps in the operation of these regulations with many of the qualifying details omitted:

1. *Period of Effectiveness*: These orders go into effect immediately upon the transmission of either of these signals:

   (a) 13-3-13—The Air Raid Alarm signal.

   (b) 10-10-10—The signal for making special assignments and regulations effective.

   The department reverts to ordinary assignments upon the transmission of the signal 12-12-12.

2. *Companies Divided*: Upon the transmission of either 13-3-13 or 10-10-10, all Engine Companies equipped with a pumper and a regulation hose wagon are divided into two one-piece Companies. Double Engine Companies are divided into three or four separate Companies, depending upon the number of hose wagons in the original Company. Each unit then operates as a one-piece Engine Company. Members on regular tour of duty man the first section, while additional sections are manned by the members performing a "V" (voluntary) tour of duty, supplemented by the officers, firemen and Auxiliaries recalled to duty. It is important to note that all sections of divided Companies, even those consisting of only a hose wagon, answer alarms as engine companies. Of course, if poor water pressure at the scene of a fire requires the presence of pumping engines rather than hose wagons, the Dispatcher is authorized to send as many pumpers as the Officer in Charge may deem necessary.

3. *Reserve and Spare Apparatus*: Additional Companies are formed by placing in service and manning all pumpers and ladder trucks ordinarily classified as reserves or spares.

4. *Existing Assignments Suspended*: With certain exceptions,

the Assignments of Companies, Chief Officers and Special Units to street boxes and Special Building boxes, as shown on the assignment cards, are suspended. Special Building box alarms, 1st, 2nd, 3rd, 4th and 5th alarms will be transmitted in the usual manner, but the responses of Companies to these alarms is radically changed.

5. *Telephone Alarms*: Alarms received by telephone will be responded to by the first due Engine Company, the first due Truck Company and, if he is in service, the first due Battalion Chief. After notifying these units by telephone, the Dispatcher will transmit a first alarm for the nearest street box. No box alarm will be transmitted for a brush fire and only one Engine Company will respond.

6. *Special Building Boxes*: The Dispatcher will continue to provide a full assignment for Special Building box alarms originating from schools, hospitals, asylums and theatres.

   All other Special Building box alarms will be sent over the alarm circuits as usual, but will be answered by one Engine and one Truck Company. If available, the first due Battalion Chief also responds.

7. *First Alarms*: First Alarms from street boxes will be transmitted by telegraph over the alarm circuits in the usual manner but will be answered by only one Engine and one Truck Company and, if he is in service, the first due Battalion Chief.

8. *Greater Alarms*: Second and greater alarms will be sent from a street box in the conventional manner or over the department two-way radio system. They will then be transmitted, as usual, over the alarm circuits but the Dispatcher using the existing assignment cards as a guide, will telephone the units that are to respond.

   This uniform response of companies to all alarms throughout the City will be adhered to:

ALARM	NO. OF ENG. COS.	NO. OF H & L COS.
1	1	1 (note a)
2	3	0
3	3	1
4	4	0
5	4	1

(Note a)—A Truck Company will not respond on the first alarm if one is not available up to and including a regular 5th alarm assignment, except when officers in charge of fires send in a special call for a Truck.

9. *Fireboats*: Fireboats will respond as assigned on regular first alarm assignments or in accordance with the practice of coverage in case the boat assigned on the first alarm is out of service. Additional boats will respond only on special call.

10. *Special Apparatus*: Water Towers, Rescue Companies and Fuel Wagons will respond only on special calls.

11. *Additional Companies*: If more Engine Companies are required than a 5th alarm assignment will provide, the Chief in Charge at the fire may send a call for as many as he needs. He may make his request over the two way radio or by sending a new special call which consists of the preliminary 55, followed by the box number and ending with a terminal number to indicate the number of Companies desired.

Example—Signal 55-125-5—Call for five Engine Companies to box 125.

After transmitting this special call over the alarm circuits, the Dispatcher uses the telephone in notifying the Companies he has chosen to respond.

Additional Truck Companies will be special called by the Dispatcher by means of the telephone.

12. *Radio Receivers*: Upon the transmission of an Air Raid Warning signal, radio receivers in Company quarters will be turned on and tuned to 1630 K.C. for the reception of official information and specific instructions regarding responses to alarms.

13. *Special Calls*: Special Calls for Engine and Truck Companies, Battalion Chiefs and special units may be sent from a street box in the usual manner, but will be transmitted, if possible, by telephone rather than by telegraph.

Speed in Responding

The Fire Department recognizes the importance of speed in getting to an alarm of fire. But by speed, they do not mean a wild, hair-raising, reckless chase from the Fire Station to the scene, without regard for safety. The Fire Department associates speed with alertness and precaution. It is far better to arrive a minute or two late, than not at all. Two tables are presented as follows. One treats on Speed and Alertness, the other on Precautions for Safety, when responding. They are of equal importance.

Alertness and Speed

1. It is the duty of the housewatchman to see that the zone in front of quarters is kept free of automobiles and other obstructions to insure quick response.

2. Chauffeurs are instructed to have fixed routes laid out, beforehand, for response to alarms in the district. The object is to enable Companies to respond with a minimum of travel, in the shortest time possible, and to avoid, if possible, the route taken by neighboring Companies.

3. Upon receipt of an alarm, members on duty should promptly report for duty on the apparatus floor.

4. When assured that the Company is assigned to the

alarm indicated, the Officer in Command should give an order for the starting of motors, the opening of doors and the prompt response of apparatus and members.

5. One member, preferably the housewatchman, should precede the apparatus as far as the street curb in front of quarters, to warn pedestrians and vehicular traffic.

6. Delays in leaving quarters due to cold motors, mechanical trouble, failure to count alarms properly, etc., often result in accidents because there is a tendency to make up lost time on the road. A Company leaving quarters promptly upon receipt of an alarm can proceed, without undue haste, through traffic, and will arrive at the scene of the fire within a reasonable time.

7. The average lapse of time for Companies in the New York Fire Department, between receipt of the alarm and departure from quarters, is between 8 and 10 seconds.

8. While driving the apparatus chauffeurs should not converse, even with officers, except when necessary to regulate the speed of the apparatus and to determine the route to be taken.

9. The chauffeur is responsible for the operation of apparatus, while responding to, working at, or returning from fires, and on all other occasions when the apparatus is taken to or from quarters for any purpose.

10. Pilots of fireboats are responsible for maneuvering to a location designated by the officer and are subject to disciplinary measures for recklessness.

Precautions for Safety When Responding

1. Responses to alarms should be made with all proper dispatch, consistent with safety.

2. Chauffeurs are responsible for the handling of apparatus, and will be subject to disciplinary measures where

carelessness, recklessness or other delinquency is observed.

3. Firemen should exercise care to avoid injury when boarding and riding apparatus, especially when donning boots and fire clothing while the apparatus is in motion.

4. Firemen should use hand rails and straps while riding upon apparatus; such straps and rails should be examined frequently to detect any weakness or need for repair or replacement.

5. When delayed in leaving quarters, or when the normal route of response is changed for any reason, use extreme caution while enroute to alarms, keeping in mind that other companies responding will not expect to meet the delayed apparatus.

6. When an Engine Company and any other Company are housed in the same quarters, with no dividing wall between, the Engine Company should, when both companies respond to the same signal station, leave quarters first, unless unusual circumstances make it impracticable to do so.

7. To guard against accidents while responding to alarms, bells (not sirens, for the present, due to use of these for air raid signals) should be sounded with a frequency depending upon conditions enroute.

8. The use of bells should be dispensed with, when consistent with safety, in the immediate vicinity of hospitals, theatres, churches or other places of public character, when people are likely to be assembled therein. Discretion should also be exercised when passing through hotel and residential sections during the night.

9. The chauffeur should have the apparatus under complete control at all times.

10. When approaching intersections or when turning corners, maintain a low rate of speed so that the apparatus can

be stopped before entering such intersections or turns.

11. Never attempt to pass another apparatus going in the same direction, unless signaled to do so by the Officer in Command of the apparatus ahead.

12. Avoid, when possible, streets where there are columns supporting elevated structures.

13. A low rate of speed should be maintained when traveling through congested thoroughfares; on streets under elevated structures; in railway tracks; on wet or icy pavement; on descending grades; passing over planking covering excavations; when using the treadle equipment at bridges or tunnels.

14. Extreme precaution should be exercised when driving against traffic lights.

15. When responding to alarms, use one-way streets against traffic only when absolutely necessary.

16. When returning from alarms never use one-way streets against traffic.

17. Avoid running over hose lines; burst hose may leave an operating company in a precarious position.

18. Although Fire Department apparatus is given the right-of-way when responding and returning from fires, keep in mind that automobile drivers may, for some reason, not hear the bell.

19. The condition of roadways in the district should be made known to chauffeurs by inspectional surveys. A bad rut could overturn the apparatus.

20. Apparatus not actually going to or returning from an alarm or when not engaged in service connected with the extinguishment of a fire or emergency call, should strictly observe Traffic Regulations.

Keep in mind always that an accident will not only prevent your company from getting to a fire, but may result in serious life-time injuries and in fatalities. A brief resume of some of the probable causes of accidents may prove helpful:

1. Speeding due to—
    - (a) Making up loss of time because of a slow turn-out.
    - (b) Racing other companies.
    - (c) Failure of chauffeur to gauge speed and check recklessness.
2. Lack of caution at crossings.
3. Absence of policemen at busy crossings.
4. Vehicles with closed windows failing to hear bells and yield right of way.
5. Confused pedestrians.
6. Rash confidence of automobile drivers in the traffic lights that favor him.
7. "El" pillars.
8. Snow, ice, rain impairing visibility and causing skidding.
9. Streets under repair; holes, poor lights, etc.
10. Driving against traffic on one-way street.
11. Driving on the wrong side of a two-way street.
12. Use of inexperienced drivers on apparatus.
13. Failure of brakes or other mechanical parts.

Discovering a Fire While Responding to Another Alarm

If an Engine Company or Hook and Ladder Company encounters a fire while responding to a street box alarm, the company may stop to extinguish the fire. A company responding to a 5-7 Signal, however, should not stop to extinguish a fire under these conditions unless human life is in jeopardy. A company that encounters a fire and stops to extinguish it must notify the Dispatcher. The Officer of the company that stops shall send from a street box, a signal made up as follows:

The Preliminary Signal—2-2-2

The Preliminary Signal of the Company—

5 if an Engine Company

7 if a Hook and Ladder Company

The number of the street box at fire encounter.

The number of the company—33 Engine for example. Thus the entire signal transmitted is: 2-2-2—5—369—33.

A company that encounters a fire but does not stop to extinguish it, should leave one man at the fire. His duty is to send an alarm or take whatever action that may be necessary.

Duties on Arrival

TOO MUCH STRESS cannot be placed upon the initial steps to be taken by a company when reporting in at a fire or other emergency. The efficiency and thoroughness with which the Firemen go about their job during this early stage of operations may well be the governing factor in getting the condition under control. Moments are precious. Commotion and the mistakes attendant upon commotion will prove costly. Calmness and economy of motion, a desirable combination in any phase of fire-fighting, are doubly important in getting operations under way. For this reason, the New York Fire Department outlines in its Rules and Regulations, a set procedure for duties on arrival at the source of alarms. Designed to fit almost every conceivable situation, they should be studied and analyzed, particular attention being given to their sequence. Adherence to these rules make for smoothness and a professional touch; certainly a company operating in the manner prescribed herein will appear to know its business upon arrival, get its lines stretched in the shortest possible time, and begin its job of fighting the fire without confusion or delay.

1. The first Officer to arrive at a fire shall assume full control and command until relieved by an Officer superior in rank, who shall be informed of existing conditions.

2. Upon arrival at the location indicated by an alarm, and finding no fire, the Company Officer first to arrive shall make a thorough investigation by dispatching his complement of men in various directions, and report the result, in person, to the Chief Officer first to arrive.

3. The Engine Company first to arrive at other than a false alarm shall connect to a hydrant and stretch the necessary hose lines.

4. The Officers of all companies, other than the Engine Company and Hook and Ladder Company first to arrive, shall report in person to the Officer in Command. Where it is apparent that such companies will engage in operations, pumping engines shall take tentative positions at hydrants, pending receipt of definite orders.

5. The conditions of hydrants shall be determined before any connections are made thereto.

6. Companies having first size pumpers shall, when practicable, connect to eight inch or larger sized mains.

7. It shall be the duty of the Motor and Pump Operator, when arriving at the scene of a fire, after determining the condition of the hydrant, to make connection to the hydrant and then to the pumper, making all connections tight.

8. Companies having first sized pumpers shall use the large connection at all times. The hydrant connection may be used if the element of time and the prevailing fire conditions warrant it.

9. In the high pressure districts, all Engine Companies shall use the large suction connections, except when responding to a still or a 5-7 alarm.

10. Motor and Pump Operators shall, when engaged in operating pumping engines or high pressure hydrants at fires, remain at such pumping engines or hydrants, give their undivided attention to their work, and avoid all unnecessary conversation. They shall frequently note the readings on all gauges and carefully record variations of pressure for the subsequent information of their Company Officer.

11. Each high pressure hydrant used at a fire shall be operated by the Motor and Pump Operator of the first Company

connecting thereto, who shall also operate all lines connected thereafter.

12. Motor and Pump Operators shall see that suctions, hydrant connections and hose lines are protected from damage by friction against curb or rough pavement.

13. Extreme care shall be exercised in placing apparatus at fires. Unless otherwise directed, the roadway in the immediate vicinity of a fire shall not be obstructed by apparatus, nor shall fire hydrants or the tracks of railway companies be blocked unnecessarily. Chauffeurs of Hose Wagons shall, as soon as practicable, place their apparatus in such position that they may be cared for by the Motor and Pump Operator of their company.

14. Water Towers, Hook and Ladder trucks and apparatus equipped with turret pipes, when not in use shall be situated in a position where they do not block roadways, but can be moved into action quickly.

15. Soft suctions (short lengths of ordinary hose formerly used in place of the stiff suction length for making rapid connection to a hydrant) shall not be used at a fire nor shall any such suctions be carried on the apparatus. The intent of this rule is to prevent collapse of the hose that joins the hydrant to the pumper. In the event that the regular suction or hydrant connection cannot be used due to obstruction of snow or other materials, a length of hose may be used in lieu thereof. However, when using a length of hose for this purpose, such hose shall, if possible, be connected to the regular suction or hydrant connection.

16. When an Engine Company (arriving on the first alarm at a fire where pumping engines have to be used and where one or more pumping engines are in operation) is ordered to "stretch in", its hose line shall be connected to the engine nearest the fire. If a discharge outlet is not available on such pumping engine, or if the Motor and Pump Operator

of said pumping engine reports that he cannot supply the additional hose line, due to lack of pressure as indicated on the pressure gauge, the hose line shall be connected to the next nearest pumping engine having a discharge outlet available, providing such engine is capable of furnishing the necessary pressure. The purpose of this rule is to establish a procedure which will make it possible to fully utilize the pressure which can be developed by the pumping engines, particularly those of 1000 gallons capacity, and to accelerate the stretching of hose lines; also to avoid long stretches of such lines, thereby reducing friction losses.

17. When the apparatus is placed in a position to draught water, the suction connections shall be made spanner tight; the churn valve seated; the relief valve cut out; positive displacement pumps thoroughly primed, and a discharge gate opened. Firemen assigned to Engine Companies shall take sounding before a pumper is permitted to take suction, and they shall take cognizance of the rise and fall of the tide during the period that suction is being taken, in order to prevent mud being drawn into the suction line.

18. At fires in their respective company districts, Officers shall inform the Officer in Command of any dangerous or unusual conditions.

19. Officers shall be responsible for the actions of Members of their units. Members shall remain near the Company Officer or apparatus while awaiting orders.

20. Under no circumstances shall Members of Companies enter buildings unless specifically ordered to do so.

21. Officers in Command at fires shall not unnecessarily jeopardize the lives or limbs of Members.

22. When fire occurs on the fifth or higher floor of a Building equipped with a standpipe system, the first hose line shall be connected to such system, to insure adequate supply of water.

23. At fires in buildings equipped with automatic sprinkler systems, one of the first hose lines shall be connected to the siamese, so as to be prepared to supply such systems; additional lines shall be connected, if such are necessary.

24. At fires in manufactories, plants and premises covering large areas, firemen shall utilize such fire protective equipment as may be provided, when the operations of the Department can be assisted thereby. When siamese connections are a part of such equipment, hose lines shall be connected thereto, so as to be prepared to augment the water supply. Pumping engines, if present, shall always be used for this purpose.

25. Companies equipped with 3-inch hose shall use it when connecting to standpipe or sprinkler siamese connections, or to water towers or turret pipes.

26. Officers in Command of Hook and Ladder Companies shall have control of the raising and placing of ladders, and shall permit their use only by Members, or persons being assisted by Members.

27. At any fire where adjacent buildings are in danger, the Officer in Command shall request the Commanding Officer of the Police present to assist in the removal of the occupants of such buildings, and to prevent their return until the danger is over.

28. Identification hose tags shall be placed on all lines in use. One hose tag shall be placed on the line at the hydrant or pumping engine, and the correspondingly numbered hose tag placed near the nozzle or outlet.

29. Department apparatus shall not be driven over hose lines unless absolutely necessary. Officers shall request police action, or cause a summons to be served, whenever hose in use at fires is driven over by vehicles not authorized to pass through the fire lines.

30. While on duty, all firemen shall carry a hose spanner and

hose strap. At fires, leaking couplings shall be tightened immediately.

31. In the event of a fire occurring in the vicinity of any of the various subway systems, and there is a possibility of smoke and water entering the underground portions thereof, through the sidewalk gratings, etc., the gratings, etc. shall, if possible, be covered with tarpaulins.

32. In the event of a fire or other emergency along the right-of-way of railroads, and it becomes necessary to de-energize electric conductors or to stop train traffic, the Officer in Command at such fire or emergency shall adhere to the procedure of such railroad as set forth in the Official Action Guide.

33. Units responding to Class 3 Stations on the Express Highway, Borough of Manhattan, shall proceed to the street directly beneath the location of the Class 3 Station. In order that the operating forces may not block more than one roadway, if the fire is on the Express Highway, ladders shall be raised against the side of the Highway, nearest the location of the fire. Extinguishers shall be used when practicable, and hose lines stretched so as to be available for use, if necessary.

34. Officers, directing the operation of streams, shall remain near the nozzle to direct and supervise the movements of Members. They shall also regulate the size and pressure of the stream, and avoid doing unnecessary damage.

35. When the pressure at a nozzle is insufficient, the Officer shall assign a Member to follow the line back to straighten out the hose and order the Motor and Pump Operator to increase the pressure.

36. Officers in Command at fires shall turn over all valuables received to the Officer in Command of the Fire Patrol, or to a Member of the Police Department, obtaining a receipt therefor.

37. When the conditions surrounding a fire are of a suspicious character, the Officer in Command shall immediately notify the Fire Marshall by telephone, and place a fireman in charge of the scene with instructions to prevent the disturbance of anything connected therewith. Firemen so assigned shall refrain from any discussion of the fire. They shall note the actions of persons entering the premises, which actions shall be reported to the Fire Marshall upon his arrival.

38. If the fire is in a building near an "el" structure and it is not advisable to allow trains to pass, a danger signal (lantern or flag) shall be displayed on each track, not less than 100 yards from the fire. Persons in charge of the first station in each direction shall be notified so that the current may be shut off and trains not allowed to pass until safe.

39. Whenever, during the course of operations at fires, accidents or other emergencies, it becomes necessary to communicate by telephone with other City Departments, public service corporations or agencies, Members shall transmit such messages through the Telegraph Dispatcher.

40. Special fire line cars have been granted to employees of large oil refineries living near the plant, so that they may assist the Department units operating. The services and specialized knowledge of such employees should be used by Officers in Command of a fire occurring on these premises.

41. Officers shall use sound judgment in stretching hose lines in order to avoid the use of surplus hose.

42. Hose lines shall be stretched as near to the curb as is possible, on the same side of the thoroughfare as the hydrant or pumping engine.

43. To avoid unnecessary bends and guard against injury while making running stretches, Members shall not pull hose from a fast moving apparatus while it is being run towards fires.

44. Where lines are stretched across thoroughfares or railroad tracks at night, lanterns shall be displayed to warn trains or vehicles against running over hose.

45. The Officer in Command at any fire, when such fire is under control, may, upon the request of newspaper men, issue a verbal statement. Such statement shall be official and briefly summarize what happened at the fire. No other Member shall issue any statement, or discuss a fire for publication.

46. Until conditions require its removal, the one-half inch tip shall always be attached to the controlling nozzle. At fires, when not in use, the tip shall be kept in possession of the Officer in Command of the line.

47. Member shall use discretion in the operation of controlling nozzles. Opening the valve too quickly causes a sudden release of pressure which may wrest the line from control. Closing the valve too quickly causes a sudden increase in pressure, which may cause the hose to burst.

48. Controlling nozzles developing leaks at fires shall, when not in use, be placed in some receptacle, or placed outside of the building, to prevent unnecessary water damage.

49. In freezing weather, nozzles shall be kept slightly open to prevent water freezing in the line.

50. Although deckpipes are normally equipped with 1½-inch nozzles, a 1¼-inch nozzle shall be kept available for use for any occasion where low water pressure makes it impracticable to use the larger nozzle.

51. Operations at fires; direction of hose streams; placing of ladders; the use of all tools and equipment; and the operation of motors and pumps; shall, whenever practicable, be in accordance with the instructions of the Fire College, as outlined in the Evolutions.

In addition to the foregoing, there are several additional rules that apply to response on 2nd or greater alarms:

Operations on Arrival at 2nd or Greater Alarm

1. The Officer in Command shall detail a fireman to the nearest available telephone, the number of which the fireman shall communicate to the Dispatcher. A sign shall be placed on the telephone to indicate that it is for Fire Department use only. The telephone selected should not be one in use by the Police Department, nor, if possible, a telephone which is connected to a switchboard.

2. Engine Companies responding on greater alarms shall always use the large suction connection at the hydrant.

3. Engine Companies responding on greater alarms, regardless of the size of the pumping engine, shall, when practicable, connect to an 8-inch or larger main.

4. Engine Companies equipped with 3-inch hose, when responding to 2nd or greater alarms, shall use 3-inch and open nozzles whenever practicable. When such companies are operating in the fire building or on the fire escape or roof of such building, or operating hose lines which are to be shifted frequently, the 2½-inch hose shall be connected to the 3-inch hose at the street, and a controlling nozzle used.

5. Members of Hook and Ladder Companies, responding to a 2nd or greater alarm of fire, shall, when ordered to the roof of the fire building or to the roof of a building adjoining or adjacent to the fire building, carry a roof rope, hose roller and life belt to be taken to the roof, and lower the rope so as to be prepared to hoist hose or other equipment to the roof, or to provide a means of escape for firemen, if necessary.

6. Land Engine Companies, responding to 3rd or greater alarms at which they are required to stretch 10 or more lengths of 2½-inch hose, shall place a siamese connection between the 3rd and 4th lengths from the nozzle before starting water.

7. Companies arriving on extra alarms shall, insofar as practicable, comply with the rule of stretching from the pumping engine nearest the fire, that is, if in doing so, there will be no delay in getting their hose streams into operation.

Stretching of Hose Lines

When fire is evident upon arrival, it is of vital importance that a line be stretched and brought to the scene without delay. The method of accomplishing this objective varies, dependent upon several factors. A Company equipped with one apparatus, a pumping engine, cannot employ the same tactics as a company that is equipped with a pumping engine and hose wagon. An Engine Company, no matter how equipped, operates in one manner when it encounters the hydrant first, and then the fire, and in another manner when it is the fire that is first met. A brief description of these stretches should make their utility apparent.

If the apparatus is equipped with a New York Switch Valve, it should be used to facilitate operations. If one is not available, the following procedure should be followed:

One Piece Company (Pumping Engine Only)

ENCOUNTERING HYDRANT FIRST. (FIG. 86)

(a) Man drops off at hydrant and wraps butt end of hose securely about the hydrant. Apparatus proceeds to the fire building.

(b) Men remove sufficient hose for stretch and mobile operation of nozzle, and take it into fire building.

(c) Apparatus returns to hydrant for hook-up and pumping operation.

ENCOUNTERING FIRE FIRST. (FIG. 87)

(a) Men drop off at fire building, removing sufficient hose.

(b) Apparatus then proceeds to hydrant for hook-up and pumping operation.

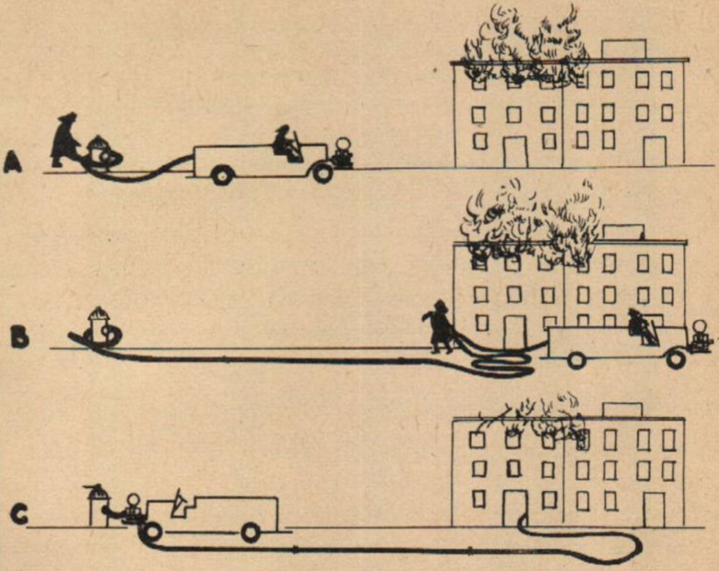


FIG. 86

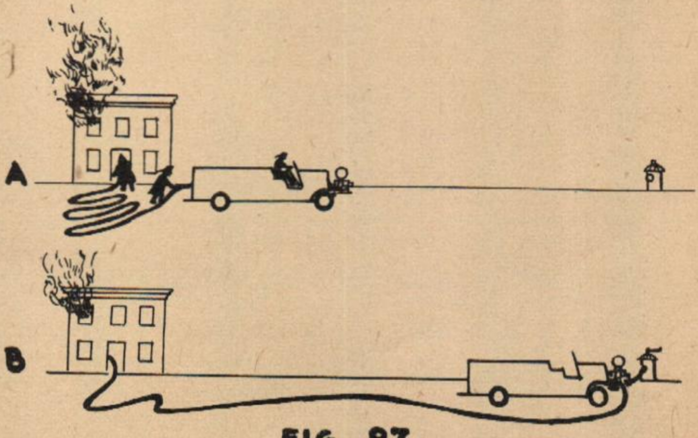


FIG. 87

Two Piece Company (Pumper And Hose Wagon)

ENCOUNTERING HYDRANT FIRST. (FIG. 88)

(a) Pumper stops at hydrant, begins hook-up immediately. Line from hose wagon, which has slowed up alongside, is wrapped about the rear wheel of the pumper, or the hydrant, so that when ready it may be attached to discharge gate.

(b) Hose wagon proceeds to cover the distance between hydrant and fire, unreeling the necessary hose as it moves. Sufficient additional hose is removed from the hose wagon in front of fire building to assure reaching floor on which you will operate, and to provide for mobility of nozzle.

ENCOUNTERING FIRE FIRST. (FIG. 89)

Either of two methods are afforded in this case, and circumstances usually govern their practicability.

The Pumper can do the job alone by stopping momentarily, while sufficient hose is being removed and brought into the building; then proceed to hydrant, unreeling the hose necessary to cover the distance. Or else—

(a) The pumper may pass the fire and go directly to the hydrant, while the hose wagon stops in front of the fire building and sufficient hose is removed.

(b) The wagon then proceeds, with the connecting end, to the pumper at the hydrant.

Where Hydrant And Fire Are In Close Proximity

The pumper alone does the job handily.

Enough hose is removed to get the nozzle started into the building.

Pumper is, at the same time, being connected to hydrant. When sufficient number of lengths are off, it remains but to attach the female end to the discharge gate.

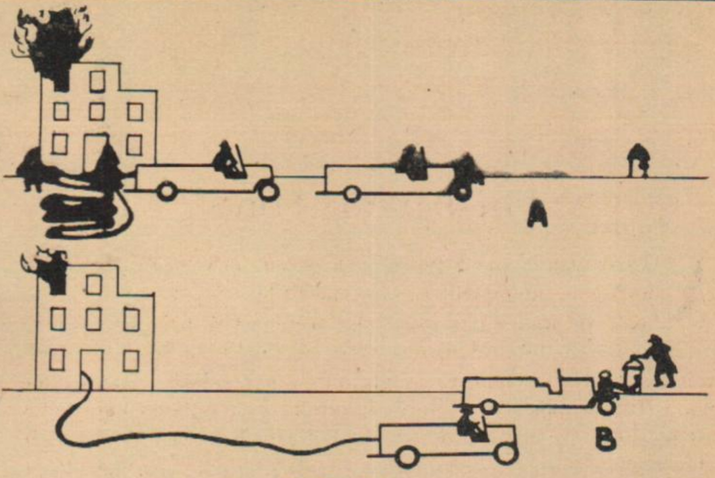


FIG. 89

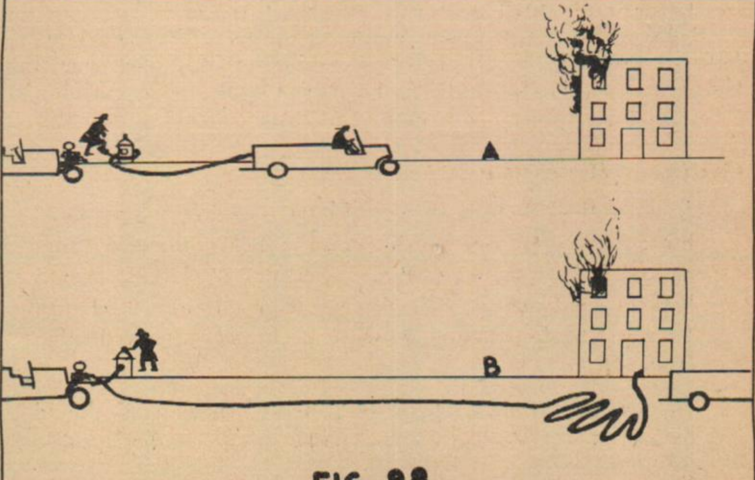


FIG. 88

Fire-fighting Hints

A KNOWLEDGE OF FIRE DEPARTMENT PRACTICE, apparatus and equipment will be of very little value to a new Fireman if, upon arrival at the scene of a fire, he permits the sight of smoke and flames to work him to a pitch of over-excitement. Excitement is contagious; its result is usually confusion. It is impossible to apply carefully accumulated knowledge and to carry out a formulated plan of attack unless men remain calm and in complete possession of all of their faculties. Coolness, economy of motion, silent efficiency and implicit obedience are the desirable attributes of an efficient Fireman.

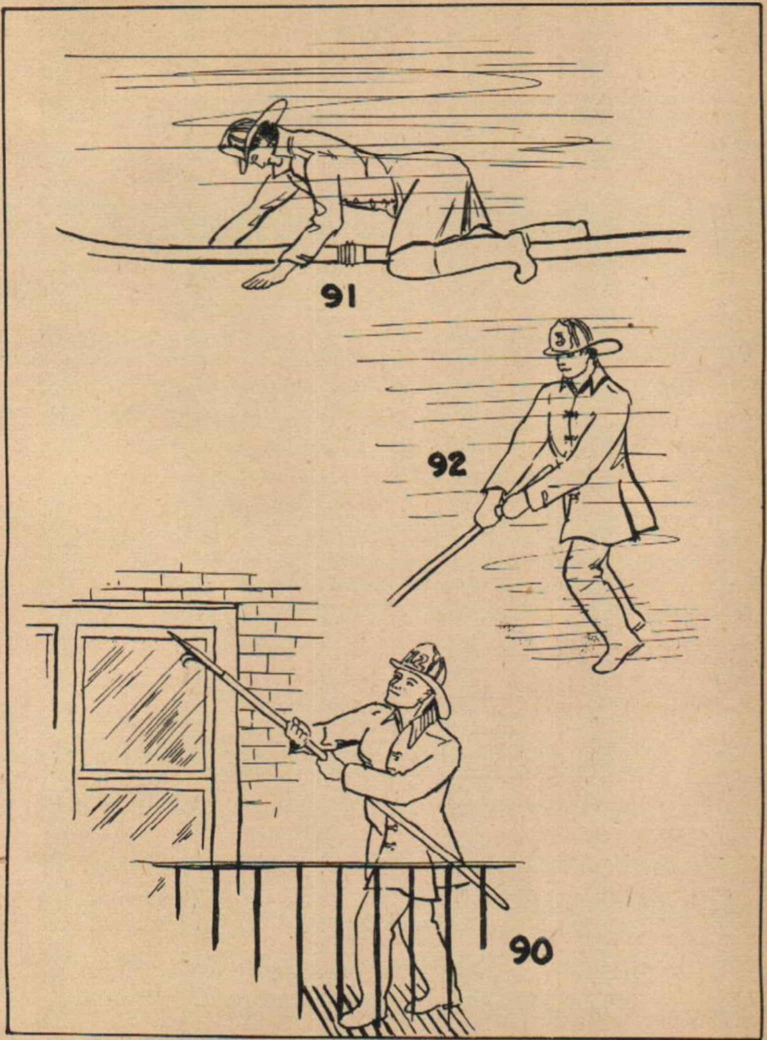
Following is a list, by no means complete, of random hints that may prove helpful. Each item is solidly based on experience. The beginner should study each precept with its underlying reason and try to make it a part of his own fund of knowledge.

Ordinary Precautions For Safety

1. In operating at fires during Winter weather, be prepared for any type of weather by wearing heavy under-clothing as well as heavy outer clothing; a change of clothing should be kept available by every fireman to enable him to change from wet to dry clothing as soon as possible after returning from a fire.

2. Helmets should always be worn at fires; rubber boots should be protected against protruding nails, etc., by leather insoles.

3. Extreme caution should be exercised in climbing and working at high levels. Snow, ice and darkness are all con-


91
3
92
12
90

tributory hazards. Always be certain as to where your next step leads.

4. Whenever a portable ladder is in use for ascending or descending, another fireman should butt the ladder at its base, in order to prevent it from slipping.

5. Firemen should avoid wearing finger rings while on duty. Accidents caused by the ring catching on hose-butts, wire or picket fences, etc., may result in severe lacerations. The removal of these rings from injured hands is sometimes a painful operation.

6. In lifting a heavy object, one's feet should be placed close together. Spreading the legs apart may cause a rupture.

7. In stepping from a ladder or from a fire-escape into a building via the window, test the strength of the flooring with one foot before entrusting it with your full weight.

8. Never toss objects of any description from upper stories without ample warning and making sure that no one below will be struck.

9. Never break glass at any height without first clearing the way and guarding against possible injury. Use a hook to break glass windows, but stand to one side when striking. (Fig. 90).

10. Ample space should be afforded men working with axes, malls and similar tools. The man wielding the axe should be sure of every stroke in advance and avoid injury to himself.

11. Firemen should avoid explosions of gas by not taking lanterns or open lights in or near places where gas is escaping or has accumulated.

12. Firemen should avoid holding the metal nozzle when directing a stream that may come in contact with live wires.

13. Firemen should avoid, when possible, walking or standing

under elevator or other shafts when fire is in the upper part of the building; the cables may snap and cause the elevator cage to fall.

14. Overcrowding ladders often results in injuries. Study the limitations of the various ladders.

15. Firemen should avoid overcrowding on a badly burned stairway, especially when the stair supports have been impaired; in such cases a ladder should be placed to the top of the stairway for ascent and descent.

16. When firemen are working in courts or alleys at fires of any magnitude, they should provide means of escape beforehand if possible, by having the doors or windows of the building on the opposite side of the court ready for retreat in case the wall threatens to fall.

17. In fires in drugstores or other places where chemicals are stored, be careful about bringing about an explosion by mixing the stock.

18. Never straddle the hose line. A sudden increase in pressure may cause injury.

19. Try to keep some mental picture of the lay-out of the premises so that you may leave in a hurry, if necessary. Don't forget that a stretched hose line will lead you to the street, or to a stairway enclosure if it is standpipe hose. Keep in mind that floor boards are, as a rule, laid length-wise and should lead you to a window. (Fig. 91).

20. When opening windows in a room charged with smoke, open the window nearest you first and continue the operation while making a circuit of the room so that you will again return to the place at which you entered.

21. Never abandon a line with the nozzle open. It will "snake" about with great force and cause injuries.

22. Be careful on apparatus when leaving quarters. The doors

may be narrow in width. Don't ride at the side and don't ever attempt to ride a Hook and Ladder truck until it reaches the street.

23. Hold on with both hands when the apparatus is in motion, grasping hand rails or straps provided for that purpose.

24. Obey orders. When told to leave the building, do just that. The reasons for all orders are not readily apparent, but it is not your duty to judge and decide. Obey!

25. Report all injuries sustained to your immediate superior.

Fire-Fighting Efficiency

1. Each man should remain close to his unit unless designated for some specific duty or errand.

2. Upon arrival at the scene of a fire, the first due Engine Company and Hook and Ladder Company carry out their necessary duties immediately.

3. The Officers in Command of all units other than the first due Engine and Hook and Ladder Companies must report for orders to the Officer in Command at the scene.

   (The Officer in Command at a fire is the Officer or Acting Officer on duty and in immediate command of one or more department units. The Officer in Command may be a Lieutenant or Acting Lieutenant, if no superior in rank is present. Likewise, it may be a Captain, until the arrival of a Chief Officer.)

4. Members of units other than the first due Engine and Truck shall remain near the apparatus or Company Officer while awaiting orders.

5. Upon receipt of orders to "stretch", and the number of hose lengths desired will be designated by your Officer, remove the amount of hose specified quickly and silently. Speed and neatness in this operation may be achieved by Firemen approaching the rear step of pumper or hose wagon suc-

cessively, inserting the arms within the folds of the piled hose lengths and removing to the roadway whatever his grip and strength permits.

6. Don't tangle hose when stretching. Keep it orderly so that the man with the nozzle may advance readily.
7. The man to have control of the nozzle should be designated by the Company Officer; all other men should spread out on the line to facilitate its advance. Men should be distributed in such a way as to grasp the hose near the couplings, thus preventing the lugs of the butts from catching or being retarded in any way.
8. Hose lines should be laid against the curb and on the same side of the street as the pumper or hydrant, if practicable. Thus, other apparatus will avoid running over the hose.
9. Chauffeurs should be on the alert to spot a hydrant before reaching the fire.
10. In stretching a line of hose from the apparatus, always take a sufficient number of lengths to reach the fire, and enough extra to take care of any extension of the condition. A length of hose is 50 feet. In determining the proper amount of hose to stretch, first estimate the distance from the pumper to the building involved. Then, if the line is to be taken up a stairway, allow one length for each floor to the fire floor. If the building is shallow, allow one additional length for use on the fire floor. If the building has depth, a loft building for instance, allow two lengths for this purpose. Finally, allow an extra length for good measure, as it is better to have too much than too little.
11. Variance in the foregoing rule is encountered when the line is stretched up a ladder or is extended up the fire escape by means of the fire escape hook. In such a case, where the hose is almost vertical, allow one length for three stories. Of course, these rules must be applied with judgment. The objective is to strike a happy medium between stretching

short and having an excessive amount of hose in the street.

12. Remember that the first duty of an Engine Company is to get a stream of water into operation as quickly as possible. If the lives of persons are endangered by the fire and a Truck Company is present, the line and nozzle should not be abandoned in an attempt at rescue work. Very often, getting a stream of water in action greatly reduces and sometimes entirely eliminates the danger.

13. The primary duty of a Truck Company is the removal of endangered persons to a place of safety.

14. A controlling nozzle should never be opened or shut off suddenly. The handle should be operated gradually. When opened abruptly, the entire pressure that the pumper is generating strikes the nozzle for that instant and it may be wrested from control. When closed abruptly, a "water hammer" is caused, and the hose line may burst.

15. In extremely cold weather, it is wise to leave the line partly "cracked" or open, if possible, at all times when not in use. Allowing a minute stream of water to flow from the nozzle will prevent the water in the line from freezing solid.

16. When stretching a line of hose up a fire escape or ladder, the pipeman should always keep a firm hold on the ladder or fire escape, as the sudden charging of the line may cause him to lose his balance.

17. Hose lines should not be charged with water until brought to the point from which they will operate. The added weight of water in the hose line will considerably delay its advance.

18. Two men, together with the Officer, should be at the nozzle when in operation, so as to handle the pressure with ease. Men should be relieved at the pipe, if conditions are bad, so that no one man will receive excessive and unnecessary punishment.

20 When only one man is operating an open nozzle and the pressure is too great for his strength, and no assistance is at hand, he may control its position by pressing the nozzle against some solid object or by placing his entire bodily weight upon it. Never let go of an open nozzle.

20. When operating a nozzle from a ladder, the use of a safety belt is advisable. The fireman should use his hose strap to fasten the hose to the rung of the ladder, thereby relieving back pressure.

21. Air collects in hose lines. When awaiting water at the nozzle, this air should be first discharged by manipulation of the lever on the controlling nozzle. If the nozzle is opened and discharges only air, it will serve to intensify the fire.

22. A small amount of air is always discharged with the water. This is unavoidable, but may be used to advantage by the pipeman if the going is "tough". By keeping his face close to the nozzle, the pipeman can breathe some of this air. The pipeman can get further relief from heat and smoke by using his finger to deflect a slight spray upon himself.

23. Ordinary smoke, heat and gases, being lighter than air, will rise to the highest point of an enclosed space. Therefore, when working in a heavily charged atmosphere, the Fireman should crouch low and close to the floor. If there is any air at all in the room, it will be at the floor level.

24. Since fire feeds on oxygen, and hence always seeks an opening, heat and smoke are always most severe near the open door or window of an involved area. Remember this. If possible, get inside the room, away from the door to either side. Standing in the doorway also shuts off the supply of air from those operating inside.

25. Firemen should always be careful in working in unfamiliar bearings or in severely burned structures, not to walk into shaftways or holes. Such accidents can be avoided by either

testing the security of each step with a tool such as a hook, or by proceeding cautiously on hands and knees. (Fig. 92).

26. When a building or room becomes heavily charged with smoke, heat or gases, and there has been incomplete combustion due to lack of oxygen, a back-draft or smoke explosion will sometimes occur upon the introduction of oxygen. Back-drafts are discussed at greater length in the chapter on ventilation. The essential thing is to stay clear of its path. Doorways and other entrance points are the worst spots.

27. During inside operations, unless the fire is small and localized, the stream should not be aimed at the fire itself, but should be directed at the ceiling. Thus deflected, the water will cover a greater area and will not scatter fire.

28. Water should not be directed against heated iron or steel structural supports, because on striking the hot metal, cold water will result in warping and cracking and may bring about the collapse of the building.

29. In stretching a line of hose up a stairway, the well-hole may be used if wide enough. It makes a vertical stretch and an easier stretch. The hose, however, should be fastened with hose straps at various landings to relieve strain at the couplings. When the well-hole cannot be used and the line is stretched up and around the staircase, every effort should be made to eliminate kinking.

30. Fire traveling up a stairway can be attacked with a minimum of punishment from heat and smoke, if followed up with a stream from below. The roof door, skylight or scuttle, however, must be opened to permit the heat, smoke and gas to escape.

31. One Company should never operate against another. If the fire is in the cellar and a frontal attack is ordered, no Company should attack the fire from the rear. Each Company would be pushing the fire and smoke toward the other.

Rather, let the two Companies work in unison, driving the fire backward and out.

32. Never open the door to a cellar that is heavily charged with fire until a charged line is ready to advance. If advance is impossible, a second line should be stretched and the fire attacked from front or rear of cellar. Thus cooled, the cellar may now be accessible to the line stationed at the cellar door. Cellar pipes may also be used to advantage.

33. When a Company is fighting a fire by means of the stairway, killing fire as they advance, other Companies should stretch lines by means of ladders, fire escapes or from adjoining buildings. They should direct their streams upward, and in, on each floor, if needed, but never downward, unless it is certain that the Company on the stairs have shut off their line and are in a sheltered position.

34. Never open a nozzle on mere smoke. Wait until you actually see fire. An exception to this rule is where fumes of ammonia or other acids have accumulated and may be driven back with a stream, enabling the fire-fighters to reach the seat of the fire.

35. Do not direct water on material or property that is not on fire, unless they are in imminent danger of going ablaze. Do not apply more water on a fire than is necessary to extinguish it.

36. Where electrical appliances or power are involved in fire, Firemen should avoid holding the metal nozzle in directing the stream. In order to prevent the current finding its way back to the pipeman, through the stream, the line should be held by the hose, a safe distance back from the nozzle. If available, rubber gloves should be worn.

37. Don't resort to force in opening a door until you are sure that it is locked.

38. Don't break skylights, etc., when they may be easily raised.

In any case, never break such glass while an Engine Company is working directly below.

39. In using a hook, don't pull a ceiling directly towards your body. Use the hook so that you will be clear of falling tin and debris.

40. Hook and Ladder Trucks should never be placed directly in front of the fire building or hydrant, unless such placement is absolutely necessary for the use of aerial ladders.

41. Doorways and other openings that may aid in extending the fire should be closed and kept shut until such time as a charged hose line is ready to attack the fire at the point.

42. Truckmen should cooperate in every possible way with the members of the Fire Insurance Patrol. Do not pull down ceilings, walls or other materials on merchandise that is not on fire. Allow the Patrol to spread their covers first, thus protecting such goods.

43. Do not throw any property, however damaged or insignificant, out of the building. Nothing should be removed from the building unless directly ordered to do so by the Officer in Charge. All articles of value should be turned over to the Officer in charge of the Fire Patrol.

44. At ship fires, the Officer in Command of the vessel should be consulted and the nature of the cargo ascertained. Also determine if fumigation is in progress.

45. Particular hazards known to exist in any building or area should be made known to the Officer in Command.

46. In dumbwaiter or other shaft fires, remember that it is imperative for the first line to get above the fire.

47. Suspect a cellar fire if smoke issues from upper windows, one above the other.

48. Never open up a direct stream in a place where materials in powdered or dust form are present, such as granaries, sugar

refineries, candy factories, etc. Tiny combustible particles when scattered into a cloud often ignite and cause a Dust Explosion, one of the most destructive and disastrous things that can happen at a fire.

49. If fire is traveling through a partition, feel for hot places or look for discoloration of wall-paper or blistering of paint. It will indicate fire's progress.

50. In any stretching operations keep the road of escape open for occupants. Don't occupy a stairway that is necessary for egress. Panic may result. Use ladders to the points you intend to reach, if necessary.

The Hazard of Collapse

The possibility of a structure collapsing is dependent chiefly upon four factors:

1. Nature of contents.
2. Stability of construction.
3. Length of time fire has burned.
4. Quantity of water that may have accumulated or been absorbed.

Converting the flow of water from fire hose into weight in tons should result in some precautions. The discharge from an ordinary 2½-inch line is approximately 250 gallons per minute. Each gallon of water weighs about 8-1/3 pounds. Therefore, from one line only, about a ton a minute is discharged in water weight. If five such streams are being directed on the fire, they are discharging five tons of water per minute, or 300 tons per hour. Deckpipes and Water Towers, of course, discharge much more.

These facts lead to two conclusions:

First—firemen should use water intelligently, gauging the size and duration of the stream according to the type and volume of the fire. They should either shift or shut down their lines as soon as it is evident that water is not extinguishing fire.

Secondly—firemen should realize the effect of this tremendous weight of water on a building's stability. Remember, too, that fire weakens and warps structural supports.

If, in addition, the floors must bear the weight of great volumes of water, or if such contents as woolens or baled rags expand in absorbing water and cause the bulging of walls, then there is imminent danger of a collapse of part or all of the building.

When working at a large blaze, a fireman is limited to a restricted position. He does not see the entire strategy of extinguishment and may not be aware of such dangers as a collapse. Chief Officers, however, directing extensive operations, usually are the first to sense these conditions. When ordered out of a building, even though the command seems unreasonable and hurried, firemen should obey without question or hesitation.

Exposure And Extension Hazard

Approximately 100 fires occur in New York City each day. Every one of these fires, regardless of its size, has the power of growing into a conflagration, unless checked in time. This is particularly true of fires occurring in buildings that, due to their old construction, are classified as fire hazards and stand close to structures of similar poor resistance. Blocks of tenement houses are an example. The danger of one building becoming ignited by communication of fire from an adjoining or neighboring building, is called an exposure hazard. Even in districts where fireproof construction prevails, a fire originating in a small non-fireproof building may break through the roof or through windows facing an interior shaft and enter a nearby modern building with disastrous results. Few buildings are able to withstand, for a long period, the severe heat of a neighboring fire.

Many construction features help to reduce this exposure hazard. Thick brick walls without any openings are the best means of stopping fire. Wire glass in metal frames, iron-shuttered windows, and metal fire doors are a few of the devices intended to check the entrance of fire into a building from the outside. But where no special exposure protection exists, or where the protection fails in its purpose, the Fire Department must deploy its forces and equipment to cover these hazards.

Covering exposures consists of surrounding the fire so that it will be stopped at each possible extension point. First consideration must be given to the more serious exposures. If the fire breaks through to an interior court, the building sharing that court, and most particularly the offices and areas facing it, deserve first attention.

The first method of covering exposures in a building is to close its windows and shutters. In most cases this will prevent the entrance of heat and flames from a neighboring fire and will always, at least, retard the progress of the fire. The usual method of covering exposures is by the use of streams of water to break up heat waves and flames. These effects may be achieved by operating the streams from the street. Deckpipe and Tower streams are more effective for this purpose than hand lines. But by directing the streams from the endangered building itself, possibly from a stand-pipe line, not only is the heated atmosphere cooled, but water may be played on the fire building itself, and a line is in immediate readiness in case the fire does extend to the exposed building.

Ventilation of the fire building, without stream protection, often creates an unnecessary exposure to surrounding structures, particularly if they are taller than the building so ventilated.

Hose and Fire Streams

WATER IS THE MOST COMMONLY USED FIRE EXTINGUISHING agent for three reasons: It is one of the best cooling agents available; it is chemically stable, that is, it will not break up into its component elements under ordinary fire conditions; and by flowing over burning materials, it excludes the supply of oxygen. Fire fighting advances in knowledge with every fire of consequence that is fought, but one factor remains constant. For fighting fires in ordinary combustible materials there is no weapon superior to a good stream of water, at adequate pressure, handled by competent firemen.

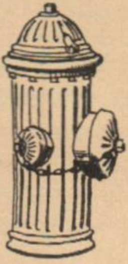
Fire streams are obtained from several sources; high pressure systems, fire engines, both land and marine, connected to low pressure hydrants or taking suction from a body of water, and gravity water systems (standpipes). The chief motive in designing fire fighting equipment is to make it possible to use water when and where it is needed. It must extinguish a fire as quickly as possible, yet with the least water damage possible. Inasmuch as the primary duty of a Fireman is fire extinguishment, he should know how to use modern fire fighting equipment so that efficient fire streams may be obtained.

Fire streams may be roughly assigned to four classifications:

1. Hand Lines.
2. Lines with special appliances (pipe-holders, etc.)
3. Deck Pipes and Water Towers.
4. Cellar Pipes.

The specific purpose of a stream must be kept in mind:

1. Is it for extinguishment of fire?
2. Is it to prevent extension by protecting exposures?



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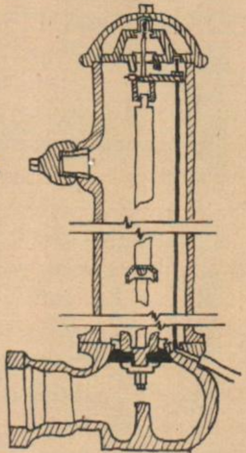

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3. Is it for temperature reduction (breaking up heat waves)?

A good fire stream is a valuable ally in saving human lives. It will form a very effective curtain and shield to permit the escape of occupants. It will hold a fire in check in one location, even though it may not extinguish it, until all humans have been evacuated. It will hold fire away from persons who have taken refuge on a fire escape balcony, by pushing the licking flames back. It will reduce scorching heat to more livable temperatures. Its importance as a means of life-saving is too obvious to recount all of its uses. Consider, then, in putting a stream to work; is life in danger? Where? Will use of water help save life? How? Clumsy or thoughtless direction of a stream of water might easily drive fire in the path of those escaping. The stream, itself a powerful force, could very well be the barrier that prevents their use of a stairway or corridor. The state or probable state of occupancy of a structure has a direct bearing on the use of effective fire streams.

The type of hose, nozzle and required fittings to be used depend upon the purpose or aim of your stream. Whereas a ¾-inch tip on a 1½-inch hose line may be ample for a bedroom fire, the same stream would be practically useless at an extensive pier fire or a large fire in a lumber yard. By the same reasoning, a 1½-inch open nozzle attached to a 3-inch line, throwing tons of water in the space of a few minutes, would hardly be appropriate for a blaze confined to a bedroom. The volume of water required, therefore, must be determined at the fire. It must be sufficient in quantity to reach the burning material and cool it to a point where it no longer glows nor continues to emit inflammable gases.

Sources Of Supply For Hose Streams

The most common source of supply for hose streams is the fire hydrant. In general, there are two classes of hydrants in New York City, the Low Pressure Hydrant (Fig. 93) and the High Pressure Hydrant (Fig. 94).

The Low Pressure Hydrant is usually equipped with two

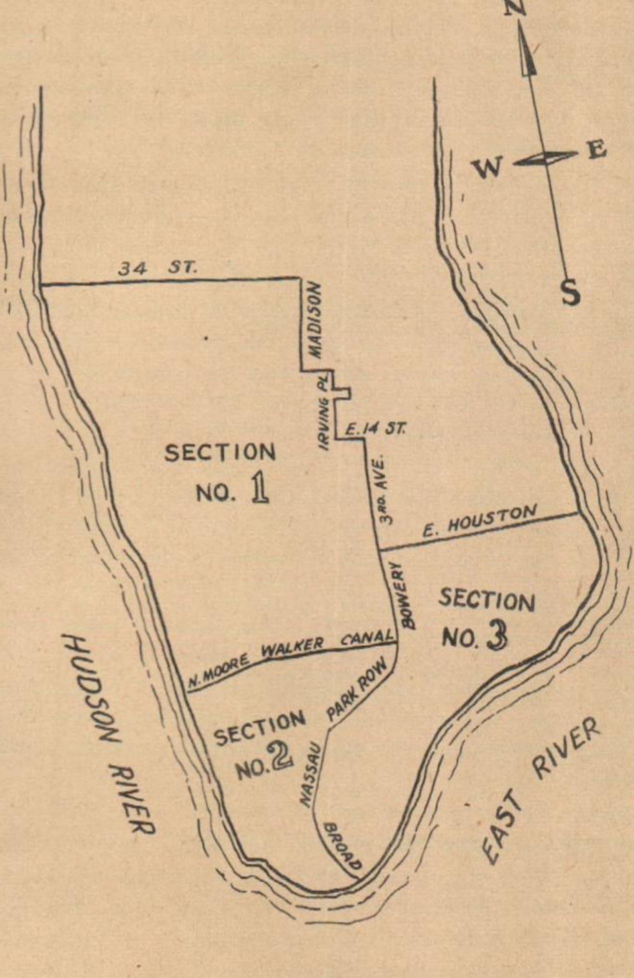

N
W
E
S
34 ST.
MADISON
IRVING PL.
E. 14 ST.
3RD. AVE.
E. HOUSTON
BOWERY
SECTION NO. 1
SECTION NO. 3
N. MOORE WALKER CANAL
PARK ROW
SECTION NO. 2
NASSAU
BROAD
HUDSON RIVER
EAST RIVER

FIG. 95

outlets or butts, one 4½ inches in diameter, the other 2½ inches in diameter. Water flows from these hydrants at varying pressures, seldom more than 50 or 60 pounds, and therefore, in order to develop an effective stream, the use of Pumping Engine is required in conjunction with the Hydrant. The Pumping Engine, fed from the Low Pressure Hydrant, takes the water into its pumps, increases its pressure to the poundage required, and expels it through the line attached to its discharge gate.

The High Pressure Hydrant requires no assistance from a Pumping Engine. It is to be found only in certain localities and receives its pressure from a central pumping station.

New York City has three distinct High Pressure Systems. Figure (95) outlines the area of Lower Manhattan that is so protected. The Borough of Brooklyn has two such systems, one guarding the Coney Island section and the other covering the mercantile and business area of downtown Brooklyn.

High Pressure Hydrants have four 3-inch outlets, or three 3-inch outlets and one 4½-inch outlet. Upon receipt of an alarm in the district in which it is located, 125 pounds pressure is available at a High Pressure Hydrant. Thus it may readily be seen that as a source of supply, such a hydrant is the equal of four pumping engines.

Bodies of water, such as rivers, lakes, etc. are a ready source of supply for good hose streams. The water is lifted to the pumping engine (either land apparatus or fireboat) through the suction process, and once the pump is primed and pressure given to the water inside the pump, the supply capacity is practically unlimited.

Gravity Water Systems provide firemen with useful fire streams when working inside tall buildings. Standpipe laws require the placement of water tanks at various heights in skyscrapers or upon roofs of moderate sized buildings. Inasmuch as water traveling downward develops pressure without outside assistance (almost a half-pound pressure for each foot of downward flow) it may be clearly seen that such tanks should and do provide good fire streams.

The source of water supply for a fire stream may be well termed the most important phase of initial firefighting tactics. Fire service mains should be at least 8 inches in diameter and cross-connected. Mains of smaller diameter are still to be found but, if possible, especially when using the large 1000-gallon pumper, the selection of an 8-inch or larger main to work from will make for more efficient streams. Members should be familiar with their district mains and pressures.

Development Of Pressure

Pressure at the nozzle is the governing factor in measuring the efficiency of a fire stream. It is the force with which the water leaves the nozzle, comparable to voltage in the measurement of electricity. While it is not necessary for a Fireman to go into the intricate mathematical phase of hydraulics, he must have a good working knowledge of pressures and their development. Insufficient pressure may be the means of a fire getting away; excessive pressure may cause a line to burst and leave men unprotected and in a tight spot. It is commonly accepted that a fire stream will travel one foot for each one pound of pressure at the nozzle.

Pressure is transmitted to the nozzle from some source of pump energy, usually from the Pumping Engine or the High Pressure Hydrant. If it were possible to obtain a stream of water at the nozzle unaffected by pressure loss due to friction in the hose, the need of knowledge of hydraulics would be greatly reduced. But between the water and the lining of the hose a certain amount of friction is created, just as the runners of a sled create friction when drawn along a surface that is none too slippery. This friction tends to retard the water through the line, robbing it of pressure that it had when it left the pumping engine or the hydrant. Several factors govern the amount of pressure that will be lost by friction. The more important of these are the condition of the lining (smooth or rough), the length of hose stretched, and the speed or velocity, at which the water is traveling.

Table of Effective Nozzle Pressures

1. Inside work—small area —30 to 40 lbs. per sq. inch
2 " " —large area —40 to 50 " " " "
3. General outside work —40 to 60 " " " "
4. Deckpipes —60 to 90 " " " "
5. Water Tower—Inter. Nozzle —60 to 90 " " " "
6. " " —M'mast Nozzle —75 to 100 " " " "

(NOTE: Nozzle Pressures in excess of 100 lbs. are not usually advisable.)

Remembering that about a half-pound (.434) of pressure is lost for each foot of height the nozzle is above the pumping engine, and aware of the fact that the 100 or 150 pounds pressure which registers on the pumper's gauge is going to diminish between the discharge gate and the nozzle because of friction, it is essential then to have some means of reckoning quickly, for practical usage, how much the approximate loss will be.

One method of quick calculation should be memorized. The following little table gives satisfactory results:

1 -inch nozzle — ⅛th
1⅛-inch nozzle — 1/6th
1¼-inch nozzle — ¼th
1½-inch nozzle — ½

of the necessary nozzle pressure for each length stretched; plus 5 lbs. per floor, plus required Nozzle Pressure.

For example, you encounter a fire and estimate a required pressure of 36 pounds at the nozzle; your nozzle, we shall assume, is 1⅛-inch. Four hundred feet of 2½-inch hose is stretched to the third floor of a building above the street level. To find, by using the above table, the proper amount of pressure to be generated by your Pumping Engine, you would calculate as follows: 1/6th of 36 is 6, and, because there are 8 lengths in a 400 foot stretch, multiply 8 by 6, or 48; adding 5 lbs. for each of the three floors upward gives a total of 63. Finally, add the required Nozzle Pressure of 36 and you have a total of 99 pounds. You instantly see that by ordering in the neighborhood of 100 lbs. on the Pumping Engine, you will get the desired stream.

Another, and perhaps more simple method for quick and accurate results is merely to figure the friction loss in the line.

Once friction loss is known, it requires only the addition of desired nozzle pressure to friction loss, plus any loss due to elevation, to determine the required pressure at the Pumping Engine.

Below is a short-cut method of calculating friction loss in 100 feet of 2½-inch hose:

1 -inch nozzle — 1/5th of Nozzle Pressure.
1⅛-inch ” — 1/3rd of ” ”
1¼-inch ” — ½ of ” ”
1½-inch ” — Full Nozzle Pressure.

Applying this scheme to the problem previously stated gives these results: The nozzle is 1⅛-inch and the nozzle pressure is 36. Hence 1/3 of 36 is 12, which is the friction loss in 100 feet of hose. Since there are 400 feet in the entire stretch, multiplying 12 by 4 gives 48. Next add 15 pounds for elevating the stream to a height of three stories—48 plus 15 equals 63. To this last figure add the nozzle pressure—63 plus 36 equals 99 pounds, which is identical to the result obtained by the first method.

Hose Usage

1 -inch hose— Chemical Tank fires and washing down operations. This type hose is carried by City Service Trucks for use with the chemical tanks.
1½- ” ” — Small tenement fires, except in cellars, and washing down operations.
2½- ” ” — Inside streams.
3 - ” ” — Outside streams; standpipe, sprinkler, deckpipe and water tower feed.
3½- ” ” — Fireboats and Relay Hose Apparatus.
4 - ” ” — Water Tower (mainmast only).

Hose of the 2½-inch size is most commonly used in fire extinguishment. Not too heavy (about 65 lbs. per 50 ft. length when empty), it is easily handled and advanced if firemen spread out along the line and put their strength into the job. When equipped with a 1⅛-inch or 1¼-inch controlling nozzle, it throws a stream of from 250 to 300 gallons per minute at from

40 to 60 pounds pressure. This is considered a good fire stream for inside operations. The water and pressure are ample, and what is more, it is under complete control at all times. When its purpose is accomplished, it may be shut off at once.

Three-inch hose is used for outside streams and for standpipe, sprinkler, deckpipe and water tower feed, because it provides a much heavier flow and because it has less friction loss than 2½-inch hose. That is, there is less pressure loss between the pumping engine and the nozzle, due to friction in the waterway. Because the sounding of a 2nd or greater alarm indicates a large fire or a fire that menaces surrounding structures, the Department rules that 3-inch hose with open nozzle be used, if practicable, when answering multiple alarms.

Only fireboats and the Relay Hose Apparatus carry the 3½-inch hose. It may readily be seen that the stream from such a hose, little hindered by friction loss and attached to strong pumps, is powerful. Ship fires and pier fires require such mighty streams.

The 1½-inch hose is of great value in fighting a small fire in a tenement or private dwelling, except in cellars. It is advanced with ease and speed and its stream will extinguish most ordinary fires, but, as a precautionary measure, 1½-inch hose streams should be backed up by 2½-inch hose streams, in the event the fire gets beyond the control of the smaller stream.

Nozzle Usage

1. ½-inch or ⅝-inch tip—For an inside position where the fire is small; for washing down operations after the fire.
2. 1⅛-inch nozzle—For inside position in a good tenement fire; for a long stretch in order to overcome excessive pressure loss due to friction.
3. 1¼-inch nozzle—For hand lines in mercantile or loft buildings; for High Pressure usage.
4. 1½-inch to 2-inch nozzle—Deckpipes and Water Towers.

The opening of a nozzle, also called the bore or the orifice, determines the quantity of water it will discharge. Larger nozzles, of course, throw heavier streams. It also plays its part in governing the pressure in pounds per square inch of the stream as it leaves the nozzle. As you may know from using a garden hose nozzle, reduce the opening or orifice and you increase the pressure.

The choice of the proper nozzle for a particular problem is important. Each nozzle that the Department carries has certain advantages. Study each nozzle and what it will do to give an effective stream and you will be able to select the correct nozzle for every type fire. The Controlling Nozzle avoids excessive water damage and water waste; it permits rapid shifting of the hose line; it gives complete control of the discharge to its operator. The Open, or Smooth Bore Nozzle is for continuous work at a large fire. A large sized nozzle has the advantage over a small sized nozzle in that it has greater carrying capacity and extinguishing effect, though unwieldy and requiring much water. A small sized nozzle has the advantage when mobility is desired. A long nozzle gives a greater range of stream and a more solid discharge than a short nozzle, but a short nozzle is easier handled and is better for close work. It is a fact worthy of note, that where a large body of water needs to be concentrated in one spot, a stream from a single large sized nozzle is preferable to a number of smaller streams, even though the water delivery is equal.

Another method for determining the proper size nozzle to employ, and a more accurate one, for it takes into consideration the length of line stretched, is to divide stretches into 3 classes. Any stretch under 6 lengths, or 300 feet, is a "short" stretch. From 6 to 12 lengths, 300 to 600 feet, is a "medium" stretch. Over twelve lengths or 600 feet, is a "long" stretch. When working with a "short" stretch, merely divide the diameter of the hose employed by 2 to find the proper sized nozzle. (A-p. 144). For a "medium" stretch, divide the hose diameter by 2 and subtract 1 size (1/8-inch — B-p. 144). For a "long" stretch, divide the hose diameter by 2 and subtract 2 sizes (1/4-inch—C-p. 144).

(A) — for example: a 1¼-inch nozzle is suitable for a stretch of 5 lengths of 2½-inch hose.

(B) — for example: if 10 lengths of 2½-inch hose are stretched, a 1⅛-inch nozzle should be used.

(C) — for example: a stretch of 16 lengths of 2½-inch hose requires a 1-inch nozzle.

There are times when the selection of a nozzle other than one of the straight bore type is essential. A cellar condition, where smoke, heat and fumes are of such a density as to prevent the advance of an ordinary line, would indicate instead the choice of one of the various cellar pipes. While the range of these devices is not as good as that of a common nozzle, they are very effective for the purpose employed and permit subsequent advance of a hand line. Study the physical construction of cellar pipes and distributors, as outlined in the chapter on Tools. Practice putting them to work. Get the "feel" of a New York Nozzle, for working in walls and partitions it will throw water at angles that no ordinary nozzle will attain.

Water Delivery From Nozzles

As previously stated, the size of a stream, as far as water delivery is concerned, is determined on the fire ground. If the fire is small and under control, use a tip on the nozzle and prevent damage by water. Remember that a 1¼-inch nozzle delivers about 300 gallons per minute, weighing more than one ton. Deckpipes deliver 500 to 600 gallons per minute at 60 to 90 lbs. pressure through a 1½-inch nozzle. Water Towers deliver from 1000 to 1200 gallons per minute at 75 to 100 lbs. pressure, through a 2-inch nozzle. A large, hot fire in a lumber yard, pier or amusement park, or where a complete structure is involved, justifies the throwing of all the water available. A fire in a dwelling or office may be put out with a pail of water or, if necessary, the discharge of a small-tipped nozzle.

Use of Heavy Streams

1. LARGE AREAS — where light streams will not penetrate, churches, armories, lumber yards, amusement parks, etc.
2. DISTANCE —When, because of smoke, heat or hazard of collapse, fire must be fought at a distance.
3. LARGE BODY OF INTENSE FIRE —When small streams will actually turn into conveyors of heat by disintegrating the water into its component parts (hydrogen and oxygen).
4. PROTECTING —surrounding areas, breaking heat waves.
5. FLOODING —ships, a heavily involved cellar or the floor above a hot fire.
6. VENTING —remote and inaccessible points.

Siamesing

Heavy streams are often developed by siamesing, that is bringing two or more smaller streams into one large powerful stream, by use of the Siamese Connection. Siamesing should be done near the nozzle. This means that the two or more lines should carry the water to a point near the nozzle before entering into the Siamese Connection to lead off into the one powerful line. This reduces friction loss. Siamesing two parallel lines of 2½-inch hose reduces friction loss as much as 75 per cent. Siamesing makes possible the use of a larger nozzle and, of course, a heavier caliber stream. It permits Pumping Engines to work within their pressure capacities because of the low friction loss. In siamesing, however, it must be noted that it is possible to have two engines pumping through different lines of hose into the Siamese Connection, and only one engine delivering water through the Siamese. This occurs when the pressure at the inlet of the Siamese is greater than the pressure at one of the engines. Competent firemen must guard against this. It is overcome by having the pressure in both lines uniform at the point of entrance into the Siamese.

So that one good, effective stream will always be obtainable, even though the stretch is lengthy, the New York Fire Department rules that when 10 or more lengths of 2½-inch hose are stretched by land Engine Companies, responding to 3rd or greater alarms, a Siamese Connection must be placed between the 3rd and 4th length from the nozzle before starting water. This allows for another similar sized line at the other inlet of the Siamese, which may or may not be placed, depending upon conditions.

"Y" Connection Usage

The "Y" Connection is useful in developing two or more streams out of one powerful one. It is employed in outlying districts where hydrants are few and far between, and powerful streams are not essential for the job at hand. It is also useful along the waterfront, where the single streams may branch from a 3½-inch hose, fed from a fireboat. Such a stream from a 3½-inch line could very well supply smaller streams with adequate water at good pressures. The "Y" Connection is also handy in washing down operations, for it permits one Company to perform this duty, even in separate places, while other units are returned to quarters and are thus available for duty at other fires.

Use Of Gates

Gates, with one inlet and two, three or four outlets, are also used for dividing one strong stream into two or more smaller streams. Because each outlet is controlled by a hand-operated valve, these Gates have a distinct advantage over "Y" Connections.

Solid Streams

A good, solid stream is one which, up to the desired striking point, has not lost continuity and appears to discharge 9/10ths of the whole volume of water inside a circle 15 inches in diameter, and ¾ths of its volume inside a 10-inch circle. These are minute measurements. No fireman attempts to so measure his fire stream, but it gives an idea of what the Fire Underwriters consider a good fire stream. The solidity of a stream tells its value. If it breaks up into a spray before reaching its objective, it is not a good stream.

Defective Streams

Defective Streams may come from one or a combination of several causes. Perhaps the pressure is too low at the engine; perhaps the stretch is too long for the pressure at hand. If you are working at too high an elevation, or if the nozzle is too large, the effect will be similar. Kinks and twists may also be responsible. Then too, the engine may be drawing insufficient water; too many engines on a small sized main will do this.

Excessive pressure will cause a defective stream as well as insufficient pressure. It will result in spraying, or even burst hose. A damaged nozzle or tip will deflect your stream. Air or pulsations in the line, caused by the pump working at a vacuum, are also common causes.

Operating A Hand Line

The most common mistake for the beginner in handling a line with a Controlling Nozzle is to open the nozzle too quickly. This is bad practice. At the instant of opening you get full engine pressure without any loss, and the line may easily get away. No one man can manage 120 or 150 pounds pressure without assistance. The line should be opened slowly, pulling the lever of the Controlling Nozzle toward you gradually. The stream should be directed at the ceiling above the fire so that it may be deflected and form a shower effect over the fire area. This prevents scattering the fire. Do not be too anxious to open the nozzle. Where there is a great deal of smoke, but no great amount of heat, water should not be used until the fire is located. By waiting until the fire is seen, unnecessary water damage is avoided, and the delay of a few moments may give the smoke time to break and disclose the seat of the fire. Do not keep your line in operation when the fire no longer requires it. Shut it down. But, as in opening it up, work the control lever gradually and not abruptly.

A hand line should be secure before it is operated. Often the pressure is too great to be held by hand. For this purpose, every fireman carries a hose-strap. If the line has been brought up a staircase or fire-escape, fasten it at various points with straps. Thereby the strain, caused by the weight of the line, is relieved.

Operating Lines From Street Level. (Fig. 96)

In directing a line from street level, whether from a hand nozzle, a deckpipe or water tower, the stream should be aimed at a point just above the sill of the window for which it is intended. This makes for maximum penetration. It will enable you to hit the ceiling a good distance back in the building, thereby deflecting your stream and again forming a good shower extinguishing effect. Move the stream about from side to side; don't keep it in just one spot. If the fire is not confined to the area to which the window leads, move the line from window to window, always aiming for that target just above the sill.

Operating A Stream From A Ladder

For proper operation and safe operation of a stream from a ladder, study Fire Department Evolution Number 17. Observe the technique of advancing the line and the importance of making it secure before opening the nozzle. A nozzle with water under pressure has a definite backward reaction, the larger the nozzle, the greater the reaction; likewise the greater the nozzle pressure, the greater the reaction. The Hose Strap, properly placed, will absorb the shock of this reaction.

Standpipe And Sprinkler Work

For fires on the fifth floor or higher, the first line should be stretched into the street Siamese Connection that feeds the standpipe. Connect two 3-inch lines so that if one bursts, water will

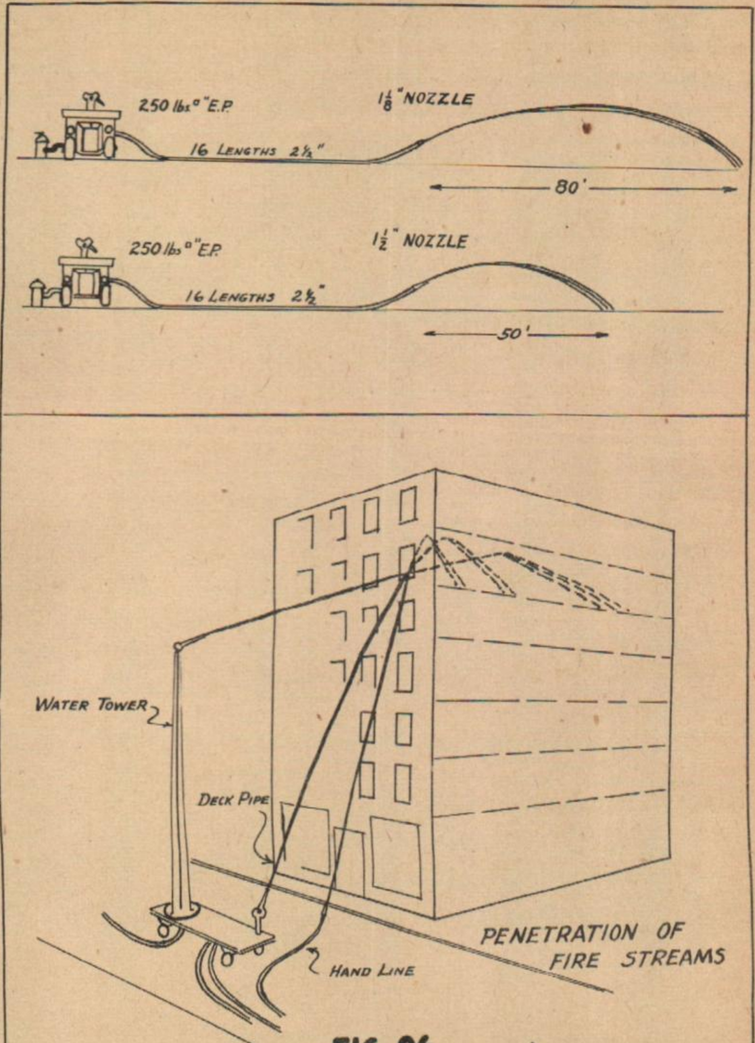

250 lbs □" E.P.
1⅛" NOZZLE
16 LENGTHS 2½"
80'
250 lbs □" E.P.
1½" NOZZLE
16 LENGTHS 2½"
50'
WATER TOWER
DECK PIPE
HAND LINE
PENETRATION OF FIRE STREAMS

FIG 96

still be supplied. The Pumper should be connected to the hydrant with the large suction so that ample water is assured. Carry up rolled-up lengths sufficient to cover the entire floor area of the building, together with controlling nozzle and the tools specified in Evolution Number 8. Station one man at the outlet valve where the hose is connected to open the valve when ordered. He should open it until the pressure at the nozzle is sufficient.

When the fire is of sufficient magnitude to warrant feeding the standpipe from the pumping engine, that is, if the supply from the tank within the building is not going to suffice, the height to which the pumper must raise the water is of tremendous importance in reckoning the required engine pressure. Friction loss in a standpipe is covered by an arbitrary allowance of 25 pounds. But do not forget that for every foot of upward flow, you are going to lose almost a half pound of pressure.

In supplying a Sprinkler System, the rules of the Fire Department require, where a building is so equipped, that one of the first lines should be stretched into the green sprinkler Siamese at street level. Pressures of from 15 to 25 lbs. on a sprinkler head are considered effective. Sprinkler heads are usually spaced so that one head covers about 80 square feet. One half of the pressure per sprinkler head, plus 15 equals the gallons per minute flow per head. It is necessary, therefore, for the man operating the pumper to know approximately how many sprinkler heads are to be fed, as well as the height to which the water must go, in order to calculate necessary engine pressure.

Relay Work

Pumpers are placed in relay, that is, at spaced intervals in a long line of hose, in order to force water through such a line and give satisfactory pressure at the nozzle. Such placement of engines in relay makes it possible to deliver water great distances without taxing the hose with excessive pressure and without too much of a burden of work on any one piece of apparatus. The technique for carrying out the relay operation is explained in Evolution Number 7.

The New York Fire Department orders that when two pumpers are used in relay, the larger pumper should be at the source of supply (hydrant or other body of water). It also rules that a pumper of the positive displacement type (not a centrifugal pump) should be at the source of supply, if its capacity is equal to or greater than the other pumper employed. These are fundamentals in relay work, designed to improve the efficiency of the undertaking.

There is no limit to the distance that water may be relayed in such an operation, just as long as a sufficient number of Pumping Engines are on hand. In London, under emergency conditions, the laying of hose in this style, with pumping units in relay to pick up the water, re-furnish it with pressure, and pass it on to the next Pumper, was used with success as a substitute for demolished water mains.

It is only necessary in relaying water for one Engine to deliver it to the next Engine, at from 10 to 15 lbs. pressure. Therefore, it is essential only to know the amount of friction loss from one engine to the next, in order to determine the required Engine pressures.

When using but two Engines in relay, the National Board of Fire Underwriters suggests that a simple rule is to place the second pumper 2/3rds of the stretch away from the first. An attempt to be more accurate is apt to result in delay. Operate the first, or hydrant pumper, in pressure gear. If the second, or relay pumper, is not more than 500 feet from the fire, operate it in capacity gear.

Fire Extinguishers

MANY FIRES ARE CONTROLLED IN THEIR INCIPIENCY, THAT is, their early stages, by some type of hand fire extinguisher. Since each type is intended for a special kind of fire and since firemen are required to be familiar with their use, limitations, placement and maintenance, a brief description of the variety of these auxiliary fire extinguishers, carried on Fire Department apparatus, is important.

CLASSIFICATION OF FIRES

These extinguishers will be discussed in connection with all types of fires which, for the sake of convenience, are divided into Classes A, B and C.

CLASS "A" FIRES — are fires in ordinary combustible substances, such as wood, paper, rubbish, rags, etc., where the quenching and cooling effects of water or of solutions largely made up of water, is most necessary.

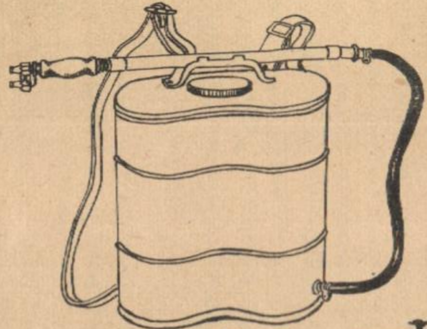
CLASS "B" FIRES — are fires in flammable liquids such as gasoline, naphtha, oils, greases, lacquers, etc., where the exclusion of air by a blanketing and smothering effect is essential.

CLASS "C" FIRES — are fires in electrical equipment, where the extinguishing agent must be a non-conductor of electricity.

Many portable extinguishers have been devised to cope with these three classes of fire. The following types are commonly used in the work of the Department:

Knapsack Pumps. (Fig. 97)

This extinguisher holds five gallons of water and is equipped



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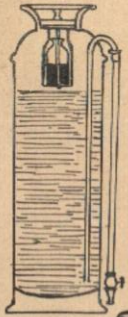

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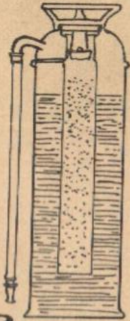

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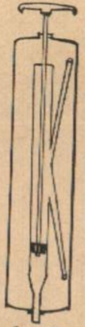

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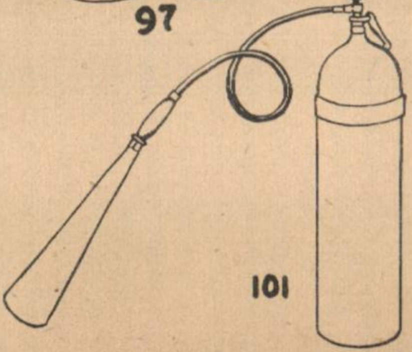

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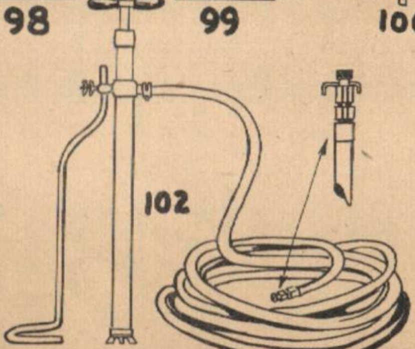

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with a shoulder harness enabling it to be carried on the back of the operator. The pressure is generated by a hand pump built right into the nozzle. It is operated by grasping the nozzle, which serves as the handle of the pump, in one hand, and the pump barrel in the other. The nozzle has interchangeable tips, one to supply a solid stream and the other a spray. It is effective on Class "A" fires and has a reach of between 30 and 40 feet.

Since this extinguisher contains only water, it is not suitable for use in temperatures below 32 degrees (F), the freezing point of water, unless an anti-freeze preparation is added to the water.

London firemen have found Knapsack Pumps very useful in extinguishing fires caused by incendiary bombs where a dual-purpose nozzle is helpful. A distinct advantage of this type pump is that it is refilled by water from any source.

Soda and Acid Extinguisher. (Fig. 98)

This is the most commonly used of all hand extinguishers. It usually comes in a 2½ gallon size and is effective on Class "A" fires. The main body of the cylinder is filled with a mixture of water and bicarbonate of soda. In a separate interior compartment, at the top, is a small bottle of sulphuric acid. When the extinguisher is inverted, the acid spills into the solution below and starts a chemical reaction. The carbon-dioxide thereby generated forces the solution from the extinguisher under pressure. Other types of Soda and Acid Extinguishers have different mechanisms for releasing or puncturing the bottle of acid. Only the water is effective in putting out the fire, the gas serving but to propel the stream. It delivers a good stream from a distance of 35 feet. The operator should aim the stream at the base of the flames.

These extinguishers must be recharged at least once a year. However, if partially used, the entire contents should be discharged into a sink or other place where the acid will cause no damage. It should then be refilled. When recharging, the hose should be examined for deterioration and the nozzle should be cleaned of any clogging matter.

A Soda and Acid Extinguisher is dangerous to use around electrical equipment. Since this extinguisher contains a large volume of water, it must be protected against freezing.

Foam Extinguisher. (Fig. 99)

The cylinder of this extinguisher is very similar to the Soda and Acid type, and is operated in the same way. That is, by turning it upside down. The main barrel is filled with a solution of water, licorice powder and bicarbonate of soda. A slender inner-chamber contains an aluminum powder which, when mixed with the other solution, forms carbon dioxide gas trapped in tough bubbles called "Foam". When applied to a fire, the mixture spreads out in a thick blanket of foam, adheres to any burning surface and shuts off air. The 2½-gallon Foam Extinguisher produces about 20 gallons of foam and has an effective range of 35 feet.

This type of extinguisher is approved on either Class "A" or Class "B" fires, but is not recommended for Class "C" fires. The usual portable size is 2½ gallons. In using foam on fires in *flammable* liquids, the discharge should be played against the inside wall of the container so that the foam will spread over the entire surface.

It is ineffective on alcohols and acids.

This extinguisher must be recharged annually and protected against freezing.

Vapor Extinguisher. (Fig. 100)

This is the type of extinguisher seen on automobile trucks, buses and subway trains. It contains carbon-tetrachloride, a non-conducting liquid, and hence it is most effective on Class "C" fires. The liquid expelled by hand pump pressure becomes a vapor upon contact with heat. The vapor, being heavier than air, settles around the fire and excludes the oxygen supply.

When a large amount of carbon tetrachloride is used on an intense fire, or comes in contact with highly heated metal, the operators must don masks in order to be protected from the poisonous effect of the vapors, particularly in confined spaces. Used in moderate quantities in rooms having a good circulation of air, there is little danger.

When applying this agent to fires in flammable liquids, the operator should direct the stream against the inside of the container and not at the fire itself. This will avoid the spread of the fire by splashing.

These extinguishers should be inspected periodically and tested yearly, by discharging a small portion of the liquid. Only liquid approved by the manufacturer should be used in the refilling process. This type is is not subject to freezing at ordinary climatic temperatures.

Carbon Dioxide Extinguisher. (Fig. 101)

These extinguishers contain liquefied carbon dioxide gas under high pressure. The flow is controlled by a hand lever and the discharge is through a horn-shaped nozzle. When released from the cylinder, the gas expands to 500 times its stored volume and solidifies into an intensely cold "snow", mixed with free carbon dioxide gas. The "snow" blankets and cools the burning material, while the gas, a non-supporter of combustion, smothers the blaze. These extinguishers are effective on small Class "A" and Class "B" fires but are most suitable for Class "C" fires. The gas will not injure the finest materials or the most delicate mechanisms. Electrical apparatus and switchboards, vulnerable to water, will not be damaged by this agent. It leaves no smoke or residue of any kind.

Frequent inspections of the extinguisher and annual weighing to detect leakage, is necessary. Recharging is supervised by representatives of the manufacturers.

These extinguishers need not be protected against cold weather since carbon dioxide has a freezing point far below the most severe climatic temperature. The contents will not become useless with age and will remain in the cylinders indefinitely.

Miscellaneous Types

In addition to the portable extinguishers listed above, many other devices may be used in an emergency. Pails of water will deal effectively with small Class "A" fires and with minor blazes in floors soaked with oils and greases, but are of no avail on such flammable liquid fires that require a blanketing effect. Fire pails containing foam should be restricted to small Class "B" fires.

Pails of sand are effective on fires in small quantities of greases and flammable liquids but will not extinguish flames in an open vat. They should not be used on blazes in ordinary combustible materials where the cooling effect of water is essential. Applications of a mixture of soda and sawdust will extinguish fires in small quantities of heavy flammable liquids, on the ground or in vats, provided it is spread rapidly over the entire burning surface.

A variety of dry fire extinguishers, with common baking soda as the principal ingredient, may be used on small Class "B" fires.

The use of all extinguishing agents applied by means of a pail, scoop or shovel is, of course, limited to fires which may be easily reached by these devices.

Stirrup Pumps. (Fig. 102)

The Fire Departments of Great Britain place great reliance on Stirrup Pumps in providing an inexpensive and efficient tool for extinguishing fires caused by incendiary bombs. This pump, resembling the familiar bicycle pump, consists of 30 feet of coiled hose attached to a cylinder equipped with a plunger type hand piston. The pump straddles a pail of water, with the stirrup on the outside. Placing the foot on a stirrup attachment keeps the pump in a rigid position. Three men are usually required in its operation, one to manipulate the nozzle, the second to man the pump, and the third to replenish the supply of water. In an emergency, two, or even one man, can perform all the necessary work.

The nozzle has interchangeable tips, giving a stream carrying 30 feet, or a spray with a range of 15 feet. Since the pump delivers one and three-quarters gallons of water per minute from a $\frac{1}{8}$-inch nozzle, the ordinary five gallon pail will supply a steady stream for approximately three minutes, sufficient time and water to extinguish a sizeable quantity of fire.

This extinguisher is valuable in fighting small domestic fires, resulting from causes other than incendiary bombs.

After using the pump, the hose should always be cleaned and neatly coiled.

Fire Pumps

THE ESSENTIAL ACTION, IN FIGHTING FIRES, IS TO GET adequate streams of water in operation on the fire in the shortest possible period of time. For this reason, the pumping engine, whose function it is to take water from a hydrant or some other source of supply, and increasing its pressure by mechanical means, to propel it through hose lines to the seat of the fire, is of primary importance.

Various types of pumps, each with its own mechanical principle, are used in the Fire Department. This chapter is intended to convey to new firemen an understanding of the fundamental working principles of pumping engines. It will not go into minute detail in discussing construction and assembly of the different types.

Physical Principles

Modern fire pumps are grouped in three classifications:

(1) Piston Pumps.

(2) Rotary Gear Pumps.

(3) Centrifugal Pumps.

In the operation of these pumps, two physical principles apply:

(1) *The positive displacement of a liquid*:

Pumps designed on this principle discharge a definite quantity of water for each revolution of the pump. The amount of water discharged is equal to the volume of the particular pump in operation.

(2) *Imparting velocity to a liquid with a moving object*:

Pumps using this principle do not discharge a definite amount of water with each revolution.

Each of the three classifications will be treated in the order in which they were developed, which is not necessarily the same as the order of their importance.

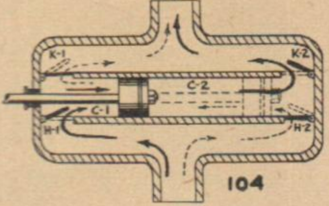
(1)—The Piston Pump

The simplest form of the Piston Pump consists of a piston rod, pulsating back and forth in a chamber, known as a cylinder. This principle is used in such ordinary, everyday appliances as a bicycle pump, or the guns used in spraying insecticides. The moving piston performs two actions; it creates pressure in front of the piston head and forms suction behind it. Just before the down-stroke, the cylinder is filled with water. Being non-compressible, even when subject to the pressure of the piston, the water forces the opening of an outlet valve and flows through the hose line to the nozzle. Thus, the liquid moves through the line by repeated motions of the piston. The faster the piston moves, the greater the pressure and velocity imparted to the stream. This is essentially the action of a single action pump, in which the "pull" of the plunger creates suction and a "push" discharges the contents of the cylinder.

Figure *103* illustrates the action of a simple type suction and force Piston Pump. A single chamber inside the cylinder is used both for a suction function and to create the force necessary to expel the water. As the piston (P) moves upward, water is forced through the suction line (S) into the cylinder (C). As the downward stroke begins, the pressure of the water closes a valve (H) on the suction line and opens a second valve (K) on the discharge line (D), allowing the water to escape from the cylinder.

Piston Pumps, as used on modern fire engines, are of the double-acting type. That is, they discharge water on both the down-stroke and the up-stroke of the piston.

Figure *104* illustrates the action of this type of pump which resembles two suction and force pumps placed end to end with a



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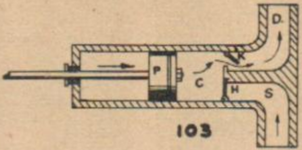

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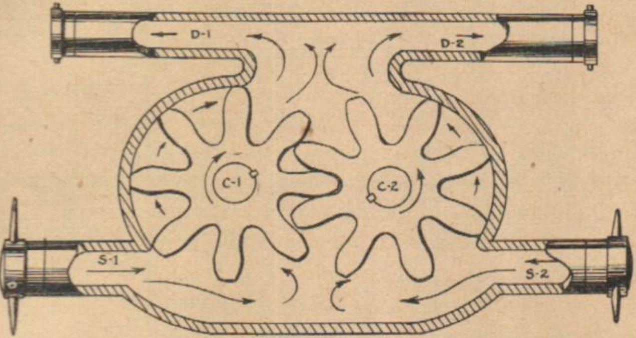

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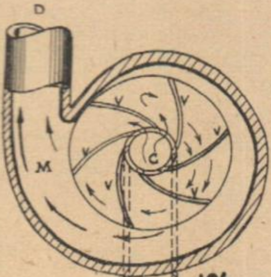

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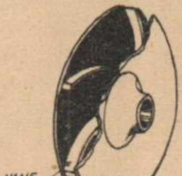

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common piston moving within a common cylinder. As the piston moves from the right to the left, the water in C-1, moving under pressure, closes the water intake valve H-1 and opens the discharge valve K-1, allowing the water to flow through the discharge gate D. At the same time that this movement has been taking place the force of the water through the suction intake opens the valve at H-2 and fills the chamber C-2, which grows increasingly large as the piston moves to the left. Thus, when the piston is in its extreme left position chamber C-1 is empty and chamber C-2 is full of water. As the piston moves to the right, the water in C-2 closes the valve at H-2, opens the discharge valve at K-2 and proceeds under pressure through the discharge gate D.

Ordinarily, a double-acting piston pump would discharge water in a series of pulsating motions. However, a spherical airdrome, mounted over the discharge chamber, serves to cushion this effect, thereby resulting in a smooth flow of water through the hose.

The motion of the Piston Pump is often called "reciprocating motion", and, hence the Piston Pump is frequently referred to as a Reciprocating Pump.

Piston Pump fire engines are manufactured with either two, four or six cylinders. Any two cylinders may be used without the remaining cylinders, thus limiting the pressure and volume of the water discharged.

If the discharge gate of a Piston Pump is closed while the pumps are in operation, it is evident that the water has no means of escape. Water being non-compressible, it will exert a counter pressure on the piston, causing it, together with the engine motor to stall. To prevent this, a by-pass controlled with a valve called the Churn Valve connects the discharge to the suction. When this valve is open, the pump continues to run as the water circulates through the by-pass.

A Piston Pump is also provided with an automatic pressure safety valve called the Relief Valve, which can be set at any desired pressure. When the pumps deliver water at that specified pressure, the valve opens to the by-pass.

These two features, the Churn Valve and the Relief Valve, are necessary on all pumps of the positive displacement type; if the discharge be stopped, and the water offers resistance to any mechanical body working to displace it, that mechanical body will also cause motion. This same fact may be expressed in a simple mathematical manner. The discharge of positive displacement pumps is directly proportional to the speed of the pump. Hence, if the discharge is zero, then the pump speed must also be zero, which means that it has stopped.

Rotary Gear Pump

The Rotary Gear Pump consists of two gears or rotors revolving inside a close-fitting case or water-tight pump housing. Water gets into the pockets between the gear teeth and, as the gears revolve, is carried upward and discharged through an outlet. The gears, as well as the casing, are water-tight, even on their curved sides, except at the intake and outlet points, thus preventing the water from slipping back to the intake suction.

Figure *105* illustrates the operation of this type pump.

The water enters through the suction intakes at S-1 and S-2 and it is picked up in the space between the impellers of gear G-1, which rotates clockwise, and those of gear G-2, which rotates counter-clockwise. Cupped in the gear cavities, the water is carried to the discharge chambers D-1 and D-2. None of the water passes through the gear teeth and as a result the path of travel is in one direction only, from the suction level of the pump casing to the discharge section at the top. Although this illustration depicts an 8-tooth rotary type pump, a type featuring gears with three teeth is also manufactured. The principle is the same in either case.

This pump, like the Piston Pump, is a positive displacement type and must be provided with a by-pass churn valve and automatic relief valve to prevent the stalling of the engine when the discharge gates or the nozzle at the end of the hose lines are closed.

Centrifugal Pump

The Centrifugal Pump is merely a special application of a simple paddle pump, exemplified by the oars that propel a row-boat or the giant paddle-wheel that imparted motion to old fashioned river boats. In the simple but familiar case of rowing a boat, the oar enters the water, pushes against it and the boat moves forward. If the boat were moored in such a way as to remain absolutely stationary and the same rowing motion was executed, the water would move away from the oar, its speed dependent upon the force and frequency of the rowing motion.

The Centrifugal Pump is designed to produce an identical paddling operation to an enclosed stream of water. The water enters the center of a circular paddle, the vanes of which are curved, to add to the pushing effect. Because the water is thrown outward from the center of the revolving impeller by centrifugal force (which simply means that the water tends to flee from the center of the circle) the pump is called a Centrifugal Pump. The casing of the pump is so constructed as to increase in space as each vane of the revolving disc adds its water to the section that leads to the discharge opening. (See Fig. *107*)

Figure *106* is an illustration of this type of pump. The water enters at the center (C) and feeds into the compartments of the disc formed by the vanes (V). As the disc revolves, the water is expelled to the outer chamber (M), flows to the widest portion of this chamber and escapes through the discharge gates (D).

If the discharge gates are gradually closed, the disc will continue to rotate and the engine motor will not stall. Therefore, no churn valve or automatic relief valve is required by this pump. Since no discharge need accompany the turning of the disc, this pump is not a positive displacement pump.

Centrifugal Pumps are manufactured for fire service with either one or more impellers and are known as single and multiple stage pumps. A multiple stage pump can be used either to deliver a large quantity of water at relatively low pressures, or a smaller quantity of water at higher pressures. If quantity of water is desirable, the manipulation of valves allows several pumps to act as independent units. In this case, the pressure of the resulting stream is equal only to the pressure developed by one pump. If pressure is more desirable than quantity, as in the case of a long stretch of line, the turning of a valve will arrange the pumps to act in series. This means that the pressure of the water is increased in passing from one pump to another. However, the amount of water discharged by the second pump depends entirely upon the amount passed to it by the first pump. Some centrifugal pumps in use in this Department have as many as eight stages.

Priming for Suction

The Centrifugal Pump, by itself, cannot produce enough vacuum in taking suction and hence must be primed by some other means. A small auxiliary pump, of the rotary gear type, is usually employed for this purpose. The priming pump is started before the regular pump. First, it discharges air, then water. When water appears at the discharge of the priming pump, the operator knows that the regular pump case is filled. Then the regular pump is started and the priming pump stopped.

Power Transmission

The engine of a fire department pumper serves two purposes: first, it produces the power that enables the apparatus to move on the road; secondly, it drives the pump.

Several different methods exist for transmitting power between the motor and the pump. The first consists of mounting the pump at the front of the apparatus, just in front of the motor, and taking power from the front end of the crankshaft. The power is transferred either through reduction gears or at direct motor speeds. The second method takes power from the rear of the crankshaft, between the motor and the road transmission, by mounting the pump behind the motor. In the third method, the pump is mounted in back of the motor and the power originates from the propeller shaft behind the road transmission. In this last system, road transmission gears must be engaged while pumping and an auxiliary clutch is necessary to prevent both transmission of power to the rear axle and the resulting motion of the apparatus.

Suction

In preparing to take suction from a body of water it is important that all connections be tight in order that an efficient vacuum be created. Vital points at which air leakage may possibly occur are at the coupling on the suction hose and the connection of this hose to the suction intake of the pumper. The churn valve and the automatic relief valve should be tightly closed. The strainer should be attached to the end of the suction and then lowered deep enough into the water to prevent the forming of any whirlpool that would admit air into the pumps.

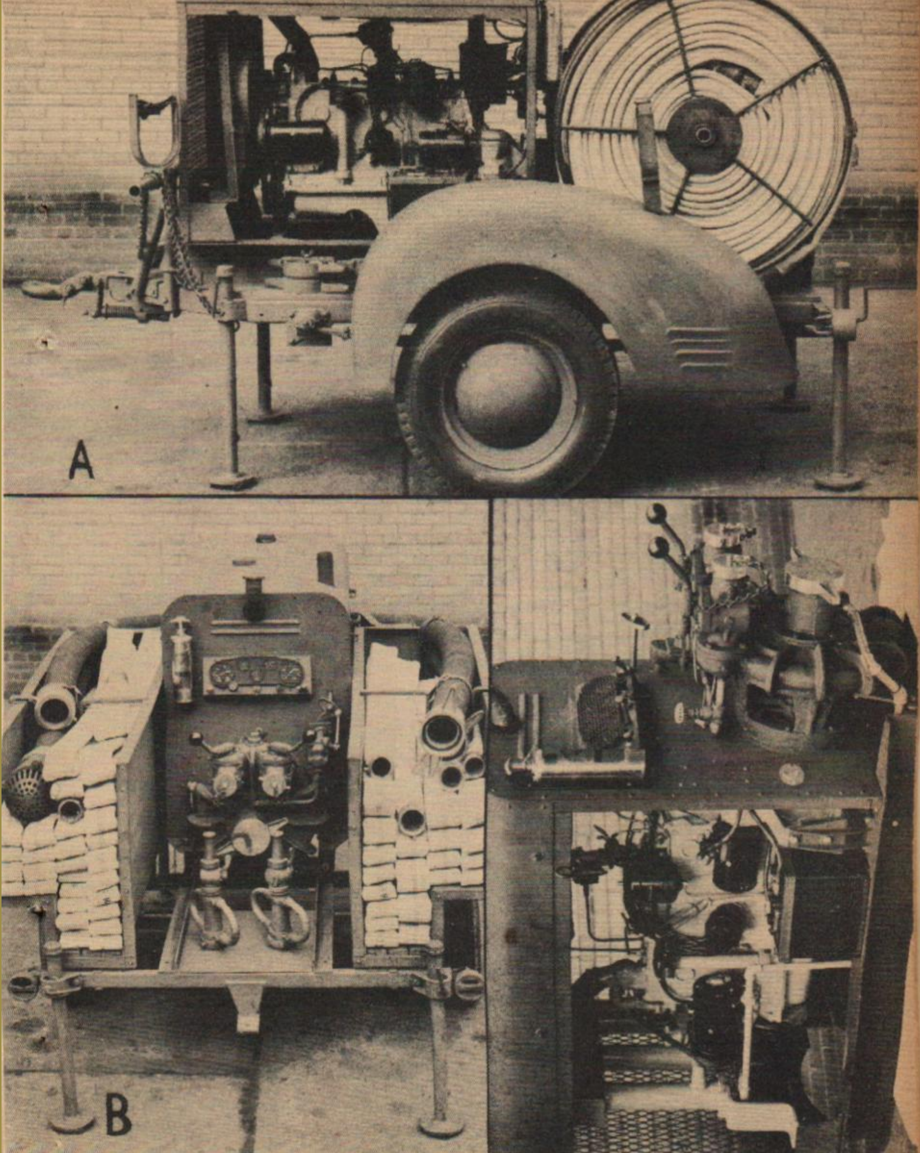
Capacity and Pressure

These words are very often used, either alone or in relation to each other, when discussing fire pumps. The word "Capacity" refers to the quantity of water discharged while the word "Pressure" refers to the force with which it leaves the discharge gate or the nozzle. When used together, these two terms are in inverse proportion to each other, that is, as one increases the other decreases. As an example of this fact, we may quote the rated capacities at which the 1000-Gallon and the 750-Gallon pumpers are expected to operate:

1000 Gallon Pumper	750 Gallon Pumper
1000 G.P.M. at 160 lbs.	750 G.P.M. at 120 lbs.
800 " " 200 "	375 " " 200 "
500 " " 320 "	250 " " 250 "
400 " " 400 "	
250 " " 600 "	

Auxiliary Cooling Systems

The water cooling system that serves to cool the gasoline motor of the apparatus may not be sufficient to keep the pumps at proper operating temperature when working under heavy load. Therefore, a connection frequently exists between the discharge manifold of the pump and the motor cooling system. A



TYPICAL TRAILER PUMPS

A—Complete Trailer Unit B—Skid Pump (mounted) C—Skid Pump (unmounted) regulating valve controls a steady flow of cool water from the pumps into the motor cooling system, augmenting the normal water circulation system. A radiator overflow takes care of any excess water beyond the capacity of this cooling system. In reference to this auxiliary cooling system, one caution is necessary, excessive pressure in the cooling system, resulting from an increase of the pump pressure, must be avoided.

A second cooling system consists of diverting the water from the radiator through a series of tubes around which cool water from the pump circulates. Thus, the heat of the water of the normal cooling system is absorbed by the cool water from the pump, which then feeds to the suction side of the pump. The degree of cooling is regulated by means of a valve controlling the flow of water from the pump.

Trailer Pumps (Fig. 108)

This type of fire-fighting apparatus has long been in service in rural sections of the country, where large pumping engines are seldom necessary. Relatively low in cost, compact, mobile and efficient, they have been considered as the means of reaching the quota of "pumpers" required by the war emergency.

The apparatus does not move on the road under its own power, but must be towed by a taxicab, private car or other vehicle. Being narrow in width it has the advantage of being able to be maneuvered through narrow streets or through streets blocked by debris. The pumping unit of some types is detachable from the main chassis and equipped with wheels, may be pushed around crowded areas by several men.

These are the specifications of a typical Trailer Pump: It is 96 inches long, 68½ inches wide, 51 inches high and weighs 2000 pounds without equipment. Its single stage, centrifugal pump is powered by a gasoline motor. The pump is rated at the capacity of 500 gallons per minute at 120 pounds pressure per square inch.

The unit is equipped with two 10-foot suction lengths, one fitted with a strainer, 2½-inch hose, nozzles and knapsack pumps.

Hook and Ladder Work

THE DUTIES OF A HOOK AND LADDER COMPANY, OR TRUCK Company as it is commonly called, differ from those of an Engine Company. Whereas the principal duties of an Engine Company are the confinement and extinguishment of fire, the duties of a Truck Company are mainly the rescuing of life and performing all of the essentials that will permit the Engine Company to advance in a fire building, such as forcible entry, ventilation, laddering, etc. The efficiency of an Engine Company may be not only impaired, but nullified, by poor work on the part of the Truck Company. A really good job of fire-fighting depends upon the coordination of the two units.

Rescuing of Life

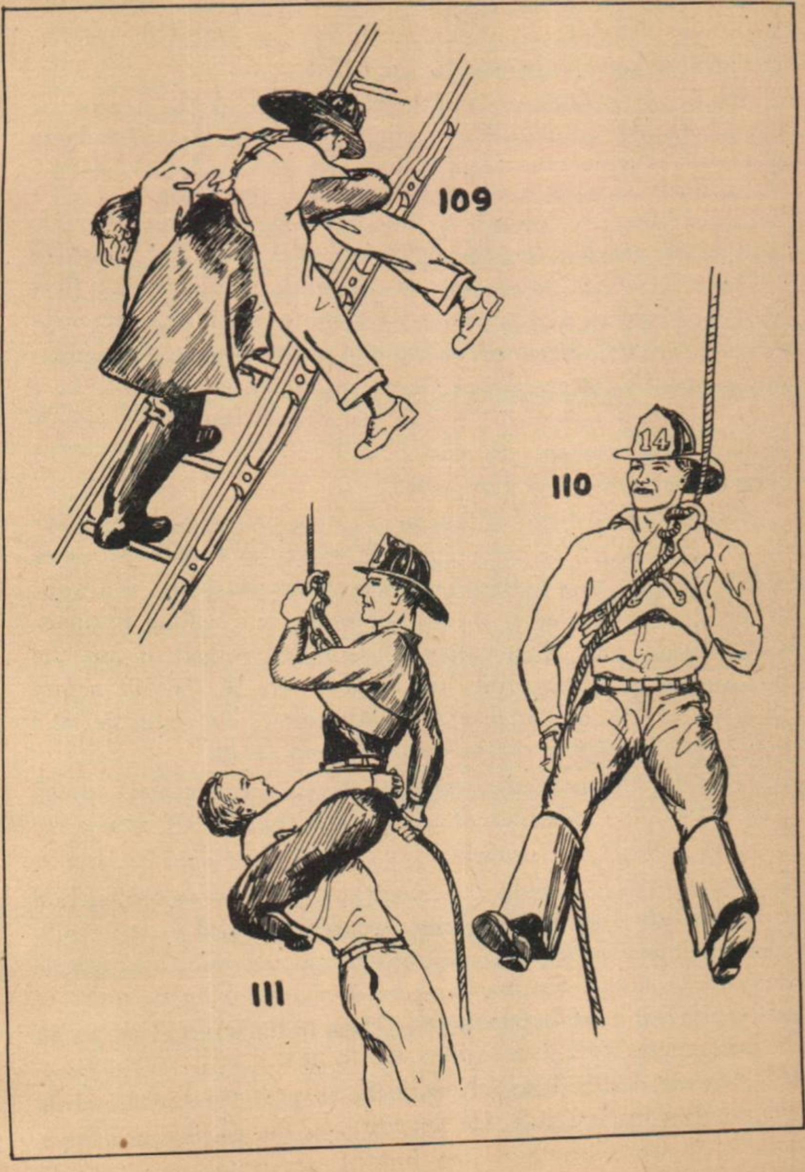
The primary duty of a Truck Company is the rescuing of human life. It is likely that this duty may delay other important Truck work, such as ventilation, but it is nevertheless of paramount importance and should receive first consideration at all times. It is also an obvious fact that all phases of Truck work, such as Forcible Entry, Ventilation, Laddering, etc., have a direct bearing on life-saving, but inasmuch as these topics will be treated at greater length in the pages that follow, it may suffice at this point to direct a few remarks at life-saving practices in general.

The first rule in rescue work is to rescue those that are in actual peril, in the safest and swiftest manner possible. By those in actual peril is meant persons whose lives are in immediate jeopardy due to heat, smoke or some other menace. Persons who have temporarily found a point of refuge should be rescued directly afterwards.

Close attention must be given to those words "safest" and "swiftest". Common means of egress, familiar to the occupants, are ordinarily the swiftest, and unless prevailing conditions have made them perilous or unserviceable, such means of escape will also be the safest. Stairways and elevators are the two most common means of evacuation. Heavy fire and smoke may render both useless, but unless this has been found to be the case, it is certainly logical that they should receive first consideration in vacating the premises. Depending upon the occupancy of the building, it is possible that Fire Drills have been conducted, and if so, every effort should be directed toward cooperating with this orderly method of mass egress. Neither the stairway nor elevator are spectacular. But an action is spectacular principally because it is dangerous. And it is danger that you are intent on preventing. It follows then, that by use of a stairway or elevator, if practicable, you are achieving your primary purpose.

The Fire Escape is another swift and safe means. Even though the stairway and elevator may be involved with fire, the Fire Escape, being of metal and in the open air, should be passable. The occupants may be led to the ground or to the roof, according to conditions. If heat and fire are not belching forth from adjoining windows, it is best to lead them to the ground. In this connection, mention should be made of the Counterbalanced Ladder. Most fire escapes do not have a stationary iron staircase between the second story and the ground, but are equipped with Counterbalanced Ladders that are held, under normal conditions by hooks or hinges, in a raised position. At a fire it is imperative that this ladder be lowered so that escape may be made to street level. An omission in this regard might cause panic and disaster, because those persons using the Fire Escape would be held up at that first balcony.

Unless the upper floors are heavily involved with fire, the roof ordinarily provides a place of refuge and means of escape. Often the roof of the next building adjoins, or the windows of this next building are accessible, affording a much safer avenue of retreat than any means in the fire building itself.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Persons may be brought to the roof by stairway, elevator or fire escape. The degree of safety afforded by use of the roof is a matter of good judgment by the officer.

When extraordinary conditions prevail, and the means of escape already mentioned are not feasible, the use of ladders proves of extreme value. The 75-foot and 85-foot Aerial Ladders in use in New York City, when extended, reach the roof of a 5-story structure with a safe descending angle of escape. Portable ladders of varying lengths up to 35 feet may be placed to windows or other points for rescue work. When saving lives by use of ladders it is better, if possible, to permit the person to descend with the rescuer preceding him or her downwards, rendering assistance and protection. Of course, circumstances sometimes make carrying necessary. If so, the rescuer must use utmost caution. One misstep may cost both lives. The best method of carrying is pictured in Fig. (*109*).

The use of Scaling Ladders in reaching points too remote for the Aerial Ladder, requires strength, agility and skill. A rescue with a Pompier, as a Scaling Ladder is sometimes called, is a work of art. Its use, however, should not stump any willing beginner with a good pair of shoulders. Observe its method of use, the importance of making the hook end secure at the sill before ascending. It is an implement of last resort, but valuable, and may mean the difference between life and death.

The Roof Rope, another rescue device, has its very special uses when other avenues of escape are cut off. Of course, to use a Roof Rope with proficiency, you must know the Fire Department knots. Make a study of all knots and their use in conjunction with the Life-Belt. A Roof Rope, securely fastened to some substantial object on a roof, may be utilized not only for persons descending singly, but may also be used for taking persons out of windows and safely transporting them to the street. This would be accomplished by first making the Roof Rope fast at the roof. The rescuer dons a Life-Belt, with the snap of the hook towards his body at the left side. He reaches over the cornice and takes up a full arm's length of the Roof Rope, which now extends from roof to ground. He then holds both the rope and his Life-belt hook (with snap held back and Life-belt hook resting on the rope) in his right hand and proceeds to make four (4) turns through and around Life-belt hook with his left hand, using the portion of the rope that is between his Life-belt and the object on roof to which it is fastened. The turns of rope around the Life-belt hook will serve as a check and regulator of the speed with which you will descend. By grasping the rope with your right hand between the Life-belt and the ground, and holding it behind the right hip, you are able to "play-out" rope and make the descent gradually and smoothly. You can stop at the window where the person is trapped, have him grasp you securely with arms and legs, then continue your descent to the street, regulating your speed as before. (Figures *110* and *111*).

Life-Nets

The use of Life-Nets is resorted to only when all other means fail. The height at which a person can jump with safety into a net is limited by the strength of the net, the weight of the jumper, his knowledge of correct descending position and by the strength of those holding the net. A jump from the third floor or higher is extremely dangerous. It is not good practice to even open a net until other methods of rescue are abandoned, for an open net is suggestive, and some persons are not aware of the great risk entailed or else are so excited and distraught that they give it no thought. They may jump needlessly when another means of rescue is already under way. These facts do not lessen the necessity for knowledge in the use of a Life-Net. Lives have been saved with nets and will be again. Men operating the Life-Net should be evenly spaced about its circular handle-rail. The modern canvas net is hinged so that it may be folded into a semi-circle. When put into operation, it is unfolded and locked in circular shape by sliding ferrules, which cover the hinged joints. Springs provide elasticity or "give" to the landing mat. The person jumping should land in a sitting position. Men holding the net should always keep their eyes on the person jumping so that the net can be quickly shifted, if necessary.

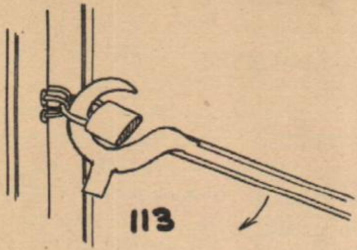
Forcible Entry

Forcible Entry, or the opening up of the fire building, so that examination may be made and lines of hose advanced, is another vital phase of Truck Work. Forcible Entry into buildings at fires should entail a study of lock-breaking, door-forcing, the opening of various types of windows and shutters, and breaching. Reference to the Chapter on Tools and Fittings will provide a man with a brief description and picturization of all Forcible Entry tools. The most commonly used implements for such work, however, in the New York Fire Department, are the Lock-Breaker, the Claw Tool, the Axe and the 6-foot Hook. It requires a lock or door of unusual strength to withstand the assault of these tools. Of course, there are many different types of doors, and the methods of forcing each type vary. But, at the same time, variety of methods which can be used to open any one of the various types of door is also numerous.

Before resorting to Forcible Entry tools, first be certain that the door is actually locked. Try the knob — it may only be stiff. Once sure that it must be forced open, observe the type of door it is, select the proper tool, and get it opened as neatly and quickly as possible. One man or two men should be able to do the job.

Using The Claw Tool

The Claw Tool is particularly effective in opening doors (Fig. 112), forcing windows, lifting iron shutters, and prying open rolling doors. Breaking a lock with the Claw Tool (Fig. 113) is a simple task if the lock is on the outside. The lock can either be twisted off with the Claw Tool by inserting the point of the tool in the staple or in the bow of the lock, and forcing the handle of the tool around, or by forcing the fork of the tool over the bow or the lock, or staple and twisting it likewise. For forcing doors inward, the fork of the Claw Tool is quite effective, being driven in between the door and the jamb, and



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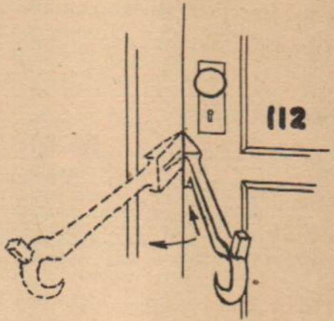

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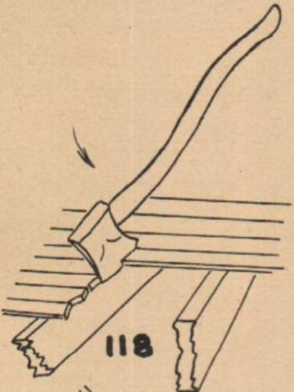

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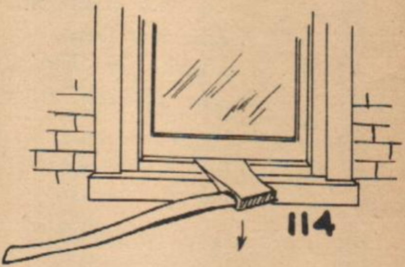

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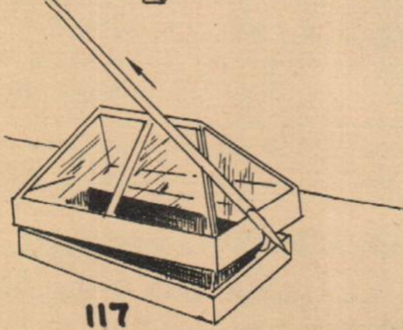

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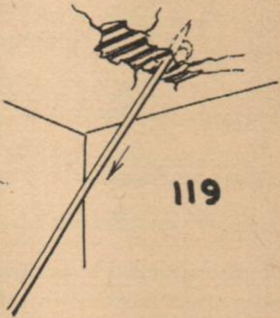

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the door pried inward. Or where the door swings outward, it can be sprung slightly with an axe and the hook of the Claw Tool hooked over the top of the door and the tool raised upward to force the door outward.

Lock Breaker

The use of the Lock Breaker on doors is somewhat similar to the use of a Claw Tool. Having no fork, however, it depends more on its wedged end, and its utility as a forcing lever. The blade is driven in between the door jamb and the door, either just above or just below the lock. The handle is then pulled outward until the door springs clear of its fastenings and opens. Quite possible, neither of the two methods mentioned in connection with the Claw Tool and the Lock Breaker will do the trick. Two methods of opening the door still remain. First, drive out a panel by using a Mall or an Axe, and get at the inside bolt that is holding it. Or else, remove the door in its entirety by working on the hinged side.

Axe

The many uses to which an axe may be put in opening up readily suggest themselves. It may be used for prying, cutting and hammering. The Axe may be driven between the hinge and the door, and when struck by another axe or heavy tool, will cut through the screws holding the hinges. On light doors, it is sometimes necessary to insert the Axe only at one hinge, and the door can be pried free.

Revolving Doors

There are but three (3) types of Revolving Doors:

(1) A Revolving Door that has a ¼-inch cable holding the doors apart; this is a panic-proof door. To close or collapse this type of door it is only necessary to push or press on the doors or wings in opposite directions, or else to hold one

wing from moving and push on the next nearest wing or door.

(2) A door with a solid arm passing through one of the doors. This is a drop-arm type. To close or collapse this type, a pawl will be found on the door which the arm passes through alongside of the arm. Press this pawl to disengage it from the arm and push the door or wing to one side.

(3) This type of door is held in position by metal-brace-arms that resemble a gate hook with eye. To close or collapse this type, it is only necessary to lift the hook and fasten back against fixed door or wing.

Vertical Doors. (Rolling Type)

These doors, which are usually found on business houses, are made of interlocking strips of metal. They are usually drawn down at the close of business each day. The fastening, which, in most cases is on the ouside, may be found at the sidewalk. It generally consists of a ring or staple set in the masonry of the sidewalk, which lines up with a similar loop or staple, or a hasp on the door. An ordinary padlock secures the ring in the sidewalk and the fastening on the door together. This lock must be broken by a sharp blow with the back of an Axe, or wrenched off with a Claw Tool. When the fastening is broken, the drop should be raised by lifting at the center, and not at the end. This prevents the door from jamming. If the lock is inside, the job is more difficult. An Axe must be wedged underneath the door till it meets the fastening. At this point, the Axe blade is driven in with the back of another Axe and the fastening broken.

Fox Locks

Opening of doors fastened with a lock of this sort is no easy task. It is necessary to spring or bend the bars of the lock sufficient to clear the sockets in which they are set at each sill of the door. It usually takes three men to open a door so equipped. The first man uses a Lock Breaker, forcing the adz end in between the door and the jamb. It may require two or even three men, using this tool, lever fashion, to spring the door sufficient to get the second tool in position. The second tool, a Claw Tool is placed in the door just above the first tool, and is put in position when the crack is made sufficiently wide to permit its entrance. As soon as the Claw Tool is in position, men on both tools begin pulling outward, that is, the men on the Lock Breaker as well as the men on the Claw Tool. This springs the door sufficiently so that another man can place the hook of a six-foot hook over the top of the door and beneath the upper sill. Then the men on the three appliances pull together until the door springs the cross-bar on the inside free from its sockets.

Opening Locked Windows. (Fig. 114)

All windows should be opened without breaking, when it is possible to do so, as falling glass is a very dangerous hazard. To open a latched or bolted window from the outside, the blade of an Axe should be inserted beneath the base of the lower sash and pried upward; this will loosen the screws away from the fastening and open the window without any material damage.

When casement or transom windows are hung on pivots or hinges at the sides of the sash, the blade of an Axe should be inserted at the top and the sash pried inward from the outside. Such windows are easily opened by this method without damage.

When such windows are hung on pivots at the centers of the top and bottom of the sash, the blade of an Axe should be inserted at the side, between the edge of the sash and window frame, and pried open from there.

Forcible Entry jobs run a wide range. Common sense and the proper choice of the tool should solve 99% of the Forcible Entry problems you will encounter. To cover the other 1%, where tools and contrivances are of no avail, you will have to batter the door down. The Battering Ram, or even the use of a 25-foot ladder, if space permits, should break through any door.

Search

While it is true that certain Truck Company operations follow an order of sequence, it must also be borne in mind that several important activities, vitally essential, may be conducted at the same time by dividing off into pairs and each group carrying out a specific job. The saving of human life, as already pointed out, takes precedence over anything else. But as soon as that factor has been taken care of, say, for instance, while two men are at work forcing entry into the building, two other men could very well be performing the initial steps in the ventilation of the building, by removal of skylights, scuttles, etc., on the roof. Truck work is not a matter of leisurely routine after the elimination of the life hazard. It is a matter of coordination, of quick, simultaneous action, all governed by good judgment and consideration of the results to ensue from actions taken.

An important phase of Truck Work, to be conducted immediately upon entry, is the systematic search of the premises for persons who have not escaped. This job is efficient only when done methodically. The fire building should be searched from top to bottom, for trapped or injured occupants. Fear of fire, inhalation of smoke, injured limbs, or actual burning, may have prevented their exit, and it is up to you as a Truckman to find them and bring them to safety. Every room, attic, corridor, closet, every portion of space where a human body might conceivably fit, and remember the body may be that of a child or infant, from roof to basement, must be combed. If the fire has been localized, held to one particular area, start there. The men should separate so that the search may proceed in all directions. They can be ventilating the premises as they go along. But if human lives, or even human bodies, are still in that building, it is your duty as a Truck Company to find them.

Upon finding an injured person or a person overcome by smoke and fumes, your knowledge of first aid serves you in good stead. Get the person to a point of safety, summon assistance for his removal, if assistance is necessary; if the point at which he is found is clear of smoke and safe from fire, and the injuries sustained preclude removal, summon medical aid to that point; apply artificial respiration when required.

Summing up, then, search of the premises involved for human lives must follow a set plan, it must be thorough, and it must be conducted immediately after entry to the building is effected.

Ladder Work

It is not at all impossible that a large percentage of your effectiveness as a Truck Company may depend upon prompt and proper laddering of the building. Fast work in the placement of the Aerial Ladder or any of the portable ladders may be the means of rescuing life in peril at any of the windows, ledges, balconies or roofs, where persons have taken refuge. A ladder to the roof permits the men chosen to ventilate, to get there quickly and do their work. Perhaps the initial attack by hose lines, because of the use of the stairway by escaping occupants or because of the location of the fire or other circumstances, may be from a ladder. A thorough knowledge of all ladders, including their proper method of raising and placement, is indispensable.

New York Fire Department Ladders

AERIALS	PORTABLES	SCALING	EXTENSIONS
85 Ft.	35 Ft.	16 Ft.	55 Ft.
75 "	30 "	14 "	16 "
65 "	25 "	12 "	
	20 "		
	15 "		
	12 " (with Hooks)		
	10 "		

While these ladders are strong and designed for heavy usage, the Department, as a precautionary measure, specifies that only a certain number of men should make use of a ladder at one time. A brief study should be made of the following table. Not only will adherence eliminate unnecessary strain, but it will also do away with overcrowding and confusion in the use of ladders.

LADDER LENGTH	MEN PERMISSIBLE
15 Feet or less	1 man
20 Feet to 30 Ft. (Incl.)	2 men
35 Feet or over	3 men
Aerial Ladder	4 men

The Aerial Ladder

The newest type aerial ladder in use by the New York Fire Department is 85 feet in length, is spring operated, and can be raised from its resting place on the truck, by one man. This lower part of the ladder, which the spring raises, is called the Bed Ladder; it is 45 feet long. If the length of the Bed Ladder is insufficient to reach the point desired, additional ladder length is procured by raising the Fly Ladder. The Fly Ladder is 42 feet long, extending from the Bed Ladder, approximately 2 feet of its length being lost in over-lapping the Bed Ladder. Two men are required to raise the Fly Ladder, operating affixed crank handles. These combined ladders may be swung to any direction by use of a turntable, on which they operate. Additional height is given to the Aerial Ladder by the 7 feet between the ground and the Pinion Support from which it juts. Thus, it may be seen that when perpendicular, the ladder extends 92 feet into the air.

Full benefit of the Aerial Ladder's 92 feet of height, however, is not obtained, for as every other ladder, it must be used at an angle to permit safe descent. To reach the 4th floor window of a building, the truck should be placed about 34 feet from the building. To reach the 5th floor window of a building, it should be placed about 21 feet away from the building. For points above the 5th story, the center of the turntable must be from 16 to 18 feet away from the building. Thus, it may be seen, that the higher the ladder is to reach, the nearer it must come to the building, and the more vertical the angle becomes.

Raising The Aerial Ladder

A few simple rules to observe in connection with the raising of an Aerial Ladder follow:

1. The truck should be properly placed. The hub cap of the rear wheel of the tractor section of the truck should be in line with the window or point to be reached.
2. The motor is then shut off, the hand-brake set and chocks placed under the wheels.
3. Remove tiller wheel, release seat and swing it aside.
4. Tormentors put in place and adjusted to take weight off tires and springs.
5. Extract fastening cotter pin and kick off the lever.
6. Brake ladder to desired height.
7. Lock ladder in position by means of "dogs" provided.
8. Release friction lock and pull up turntable lock and give it a half turn.
9. Turn table into building by use of the control wheel.
10. Tighten friction lock.
11. Lower the ladder into building, keeping the tip about one foot or 18 inches from the building.
12. To raise Fly Ladder, crank handles are used manually.
13. When finished using the ladder and ordered to lower it, lower the Fly Ladder manually, adjust the position of the "dogs" as indicated by arrows printed on the Truck.
14. Release friction lock.
15. Release turntable lock.
16. Revolve table until lock falls into position.
17. Adjust "dogs" again and lower ladder into its bed resting position on the truck.
18. Keep turning until kick-off lever comes up.
19. Place cotter pin again in position under lever.

Portable Ladders

A simple rule to remember in the placement of portable ladders is to divide their length by 5 and add 2. A 35-foot ladder, therefore, would be 35 divided by 5, or 7, plus 2, indicating that it should be placed 9 feet from the building.

Proficiency in the raising, butting, placing, carrying and lowering of these ladders, as well as facility in hoisting such a ladder up the side of a building and its use on the roof as a bridge from building to building, may best be attained by close study and practice of Evolutions Numbers 19, 20 and 21, described in Chapter No. 3. Particular attention should be paid to the 35-foot ladder. Remember that it weighs in the neighborhood of 170 pounds, and unless the men raising it work in unison, and regulate its balance, it may easily topple and cause serious injuries. A Portable Ladder of any height should always be butted when being used. That is, a man should be stationed at the foot of the ladder, place his foot on the bottom rung and his hands on the beams, thereby lending his weight and strength to keep the ladder from slipping.

In general, there are two types of Portable Ladders; the Beam Ladder and the Trussed Ladder. They differ in this respect; the beams, or sides of the Beam Ladder are straight up and down; the beams of the Trussed Ladder are noticeably curved on one face of the ladder, straight at the other. In placing a Trussed Ladder, the curved side of the trussed beam should be towards the building. The Trussed ladder is equipped with metal rod reinforcements under some of its rungs.

The fundamental parts of any portable ladder are the beams, or sides, the butts, which are placed against the ground, the top, which goes against the building, and the rungs.

12-Foot Hook Ladder

This portable ladder, equipped with metal hooks at top, is of great value in these instances:

1. Getting from one fire escape balcony to another, when there are no connecting ladders.
2. Getting to the peak of gabled roofs.
3. To get over the roofs from fire escapes, when fire escape does not go to the roof.
4. Whenever scaling ladders are not available.
5. Climbing from the deck of fireboat to railing of a ship.
6. Descending to holds of ships, or other places below level.

Scaling Ladders. (Pompiers)

These ladders are for use in reaching heights to which the Aerial Ladder will not extend. Study Evolution Number 23.

Extension Ladders

The use of Extension Ladders in the Department, other than the extension feature of the Aerial Ladder, is limited to the 16-foot and 55-foot Extension Ladders. The 16-foot ladder is a combination of two 8-foot ladders, easily extended to full length by means of guides and a halyard. It is excellent for work in confined spaces where bulkier ladders cannot be taken. The 55-foot Extension Ladder is a rarity, being carried on certain City Service Trucks on Staten Island. It is, however, a portable ladder, built in two sections. The upper section is raised by means of a cable after the lower section has been elevated to a vertical position. Two crank arms and a drum are used in conjunction with the cable, for raising purposes. This ladder has attached to the sides, or beams of the bed ladder, two hinged poles known as "tormentors" which help to keep the ladder rigid when raised. The services of six firemen are required to raise and properly place one of these 55-foot Extension Ladders.

Climbing Ladders

Climbing a ladder comes naturally to some while others must learn through practice. The two essentials in climbing are rhythm and safety. Some prefer to grasp the beams while ascending and descending, while others prefer taking every rung, or every other rung, with the hands. Use the ball of the foot in climbing, and do not run. Climb steadily and smoothly. The feet should be at the center of the ladder to prevent wobbling. The use of a Life-Belt is recommended for use at a point where you will remain stationary for some time. If one is not equipped with a Life-Belt, there is also an approved "leg-lock", whereby one leg is passed between the rungs and is bent at the knee, so as to lock the instep on the beam of the ladder. These methods leave both hands free for handling hose, tools, etc.

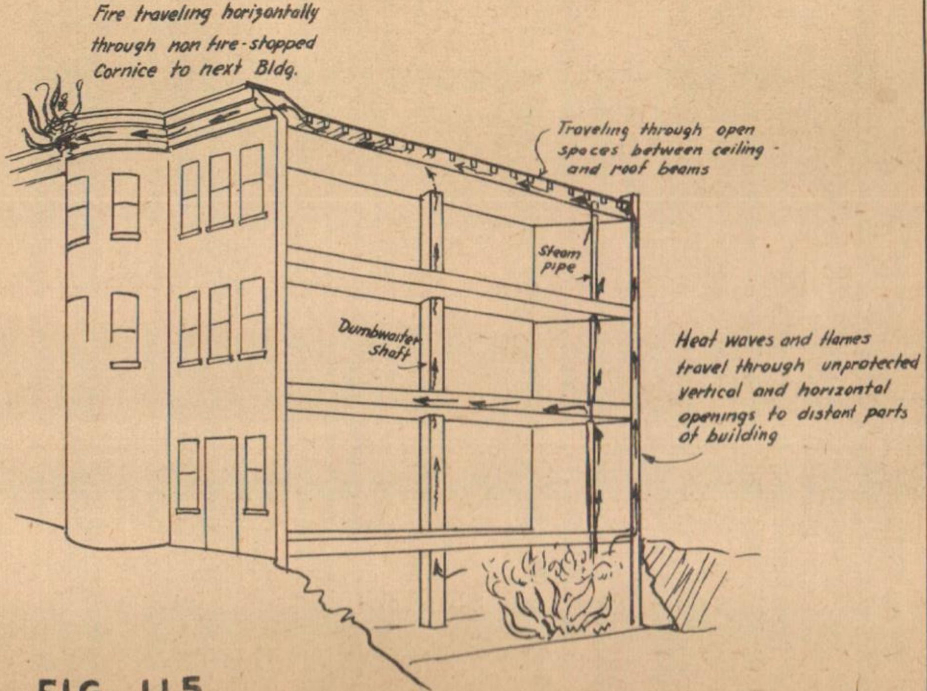

Fire traveling horizontally through non fire-stopped Cornice to next Bldg.
Traveling through open spaces between ceiling - and roof beams
Steam pipe
Dumbwaiter Shaft
Heat waves and flames travel through unprotected vertical and horizontal openings to distant parts of building

FIG. 115

Other Uses For Ladders

By striking with the butt end, Ladders may be used as Battering Rams in opening large doors, iron shutters or partitions that are a distance away or just out of reach.

The Aerial Ladder or Portable Ladder may be used for breaking windows and ventilating.

Ladders may be used as bridges from one building to another across air, light or other shafts, roofs, fire escapes, etc., by which persons or firemen may cross or escape from fire or other danger.

Ladders may be used for pushing over dangerous or loose walls from the window or roof of an adjoining building.

Aerial ladders can be used as Water Towers, by lashing hose lines thereto.

Ventilation. (Figure 115)

Proper ventilation is the release of pressure, heat, fumes, smoke and gases caused by fire to the outer air, so that efficient and rapid rescuing and extinguishment may be effected. It removes the dense smoke which both limits visibility and prevents firemen from locating the seat of the fire. It makes safe entry and advance of hose lines possible, for all of the gases generated by combustion are injurious to some degree. It minimizes the danger of such deadly agents as Carbon Monoxide.

Good ventilation requires expert judgment on the part of the Truck Company Members. No door, window or other part of a building, vessel, or premises where there is fire, should be opened when it would have a tendency to spread the fire or endanger life, or when no hose line is ready to extinguish fire. The loss of an entire building and extension of the fire to other structures may easily be caused by ventilation that is too hasty or faulty. (Fig. 116.)

Ventilation should start at the uppermost point of a building. The opening of roof outlets, such as skylights, bulkheads, scuttles, releases the smoke, hot air and gases vertically, while the cold air coming in through openings near the bottom of the building aids in pushing these fumes skyward. A closed building may be compared to the ordinary stove or furnace, with all doors closed and the damper shut. Unless the building is opened at the top first, the opening of a door or window at a lower point is about the same as putting on the draft in a furnace, without first opening up the damper. The oxygen, thus permitted to reach the fire, will increase its intensity and its tendency to generate gases. (Fig. 117.)

A window on an upper floor, if broken or opened before top ventilation is accomplished, may turn a building into a raging furnace, with flames involving all floors.

Mushrooming

Fire, heated air and gases, being lighter than air, travel upward. A fire, therefore, which starts on a lower floor, spreading unchecked, will progress vertically from floor to floor until it reaches the roof. If it finds no outlet there, the pressure which has been created by the fire gases will not permit its travel to terminate there. Pressure is energy, and this energy will keep its progress on the move. The fire, having been stopped vertically by the closed roof, will now spread out laterally on the top story. As soon as fire and gases fill this story, its only avenue of advance now is downward, and downward it goes, dropping from floor to floor, rapidly taking possession of the entire structure. The term "mushrooming", referring to this tendency of fire, should bring to mind quickly the importance of getting a building open at the top.

Ventilating Floors When Roof Coverings Are Removed

Roof coverings having been removed, ventilation is correctly begun by drawing the fire up a proper channel and away from the intervening floors. The men should then continue ventilating by open windows on the floor below the roof. Windows should be opened from the top (if they are of that style) on all sides of the structure. Following this, the men should work down, floor by floor, and ventilate as they proceed.

Ventilating Cellars And Sub-Cellars

Where it is necessary to ventilate because of a fire in a cellar or sub-cellar, the cellar doors, rear windows, exterior elevator and other shaft covers should all be removed, or opened up. Smashing the deadlights in the sidewalks at the front of the building should be done, if necessary. Where it is impossible to provide ventilation in such below-level portions of the building by the openings mentioned, release of smoke and gases may be effected by removing a board from the flooring above, making sure, however, that a line is ready at that point to check the fire's extension. Sometimes it is possible in stubborn basement fires to accelerate ventilation by concentrating several streams at the front or rear of the building, shutting down all other streams and advancing those in massed formation, thus driving the heat and smoke toward the front or rear openings, as the case may be.

Back Drafts

A back-draft is really an explosion of gases. It is the product of incomplete combustion due to lack of oxygen. Where fire has been burning for some time, and the gases generated have had no outlet, the introduction of fresh air (oxygen) is likely to produce this explosion. Men have been blown clear across the street by means of this back-draft, upon effecting entry into a store. Men have opened the door of a flat in a tenement building and have been blown down the stairs. It is seldom that the back-draft does not leave death in its wake.

There are two noticeable warnings of a back-draft condition—

1. Air being drawn sharply inward, with sort of a sucking, whistling sound.
2. Heavy volume of twisting, rolling smoke issuing from all openings with great pressure, indicating that materials burning within are burning so fast that much unburned

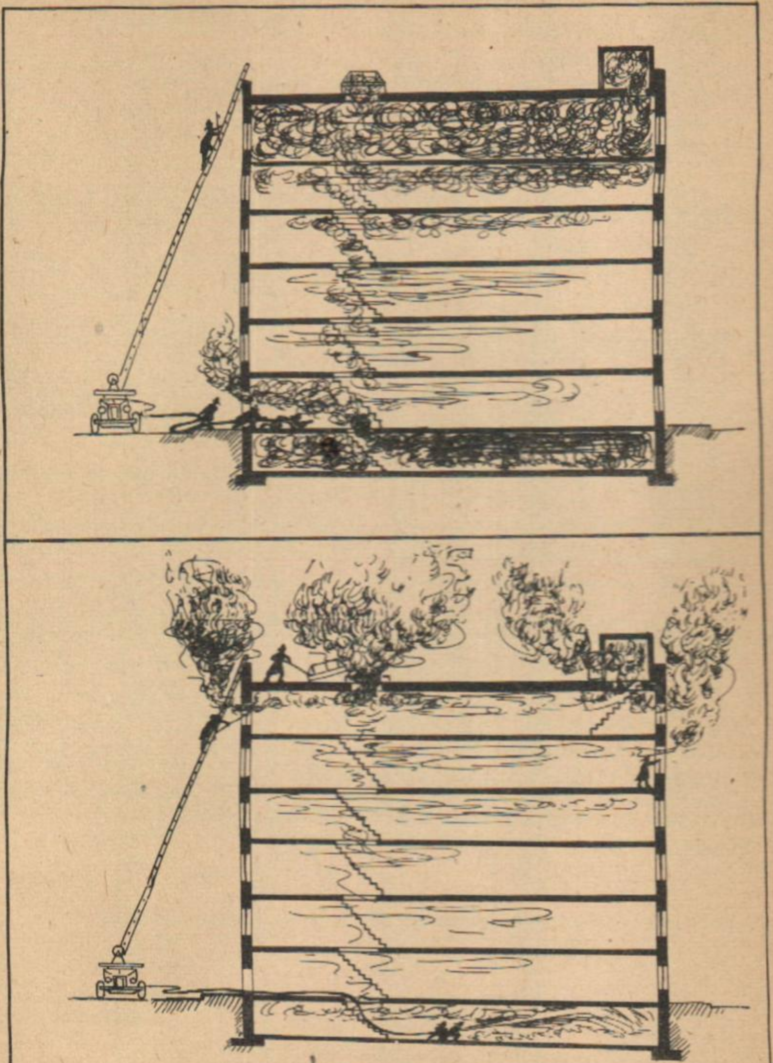


FIG. 116

gas is present and will explode violently when a new opening provides oxygen.

Precautions should be taken to eliminate the possibility of such an explosion. Have the upper part of the building or the part most distant from point of operation opened first. Await equalization of pressure within and without before entering. Also see that heavy streams are in readiness to prevent rapid extension if the explosion does occur. When the door is opened, get to one side and stay low. Direct your stream from that angle at first. Do not present your body in the direct path of the likely explosion.

Effect Of Weather On Ventilation

Good ventilation often depends on the condition of the atmosphere, or the direction of the wind at the time of the fire. On damp or foggy days, the smoke will not rise as quickly as on clear days and therefore, ventilation is more difficult. The direction in which the wind is blowing must also be considered, because the hot air and gases released from the fire building and carried by the wind may be conveyed to nearby structures and cause additional fire. This is particularly true when the nearby structures are taller than the fire building, presenting a serious exposure hazard. All precautions should be taken, to prevent such extensions by closing shutters, windows, etc. on these exposed structures. Unnecessary physical punishment in opening up an entire roof may be avoided by having the men work with their backs to the wind. Danger may be further diminished by opening up first at the end opposite that from which the wind blows.

Safety In Ventilation Work

Men assigned to ventilation work are often exposed to extreme danger. Every effort should be directed toward minimizing such danger, and to that end, wherever practicable, the following should be adhered to:

1. Have men work in pairs.
2. Always make provision for safe retreat, by aerial ladder

or portable ladder; short ladders from fire roof to the adjoining higher roofs may be used.

3. Take care with tools to avoid unnecessary injuries.
4. Use masks if necessary.
5. When opening windows from fire escape, always start at windows farthest from stair section and work back towards that point so as not to be trapped on balcony.
6. When ventilating windows of top story by use of hooks or axes from roof, see that the man using the tool is held by other men, to prevent falling.
7. Provide adequate portable lighting to safeguard against men falling into shafts, holes, etc.

Examination

Examination of the fire building and adjoining or adjacent premises is also the duty of the efficient Truck Company. While it is of primary importance and should be done as quickly as possible, it can be accomplished by men assigned to other tasks, such as ventilation and search. Examination comprises several factors. The fire building should first be inspected to determine the seat and extension of the fire. Strategic placement of lines depends upon such findings. Examination should reveal the presence of volatile liquids, gases, films or other dangerous articles. It should disclose all possibilities of the fire extending from floor to floor and from building to building, and enable the men examining to take the steps that will prevent such extension, such as closing doors, windows, shutters, etc., wherever the exposure is imminent. Shafts, ducts, pipe recesses and other means of fire travel should be quickly located and reported to the Commanding Officer so that he may order hose lines to cover these danger spots. Hanging ceilings, cock-lofts and open cornices are all carriers of heat and fire and must be inspected for defection of fire travel.

Examination work should, if necessary, include the shutting off of oil-burners, refrigeration, gas or electricity. It should disclose the type of stocks and fixtures in the building, in order to effect the removal of such stocks, if possible, from the path of the fire. It should reveal the presence of heavy machinery and safes, so that the hazard of their falling through fire-weakened floors may be anticipated.

Use of Retardants

Still another duty of the Truck Company is the quick and effective use of all auxiliary firefighting appliances with which the building or vessel is equipped.

While the Engine Company is busy stretching its lines, Members of the Truck Unit should enter the premises and do whatever work is necessary to retard or even extinguish the fire. It may be a small fire, in which case, fire pails filled with water or sand, may do the job. At least one Member of the properly equipped Truck Company carries a Fire Extinguisher of the Soda and Acid type. Many fires may be extinguished in their early stages or checked with this device.

If the building is equipped with a sprinkler system, it is the duty of the Truck Company to see if the system is operating, or perhaps, needlessly operating. If it is not operating and its use is required because of fire conditions, truckmen should investigate. A shut-off valve may have been left in a closed or clogged position. Open it! Sprinkler heads may have been covered or clogged. Do whatever is necessary to restore them to an operative condition! If heat or some accidental cause has brought about unnecessary operation of sprinkler heads, or if fire conditions do not warrant their continued spray, shut the system off by closing the indicated valve. Valuable stock has been damaged frequently, where no fire existed, by the fusing of sprinkler heads.

If heavy fire is in progress and the building is equipped with a Standpipe System, the Truck Company may be used to get water quickly on the blaze with one of the provided house lines. While the Fire Department prefers the use of its heavier, more durable hose for fire extinguishment work, the use of one of these house lines by an alert Truck Company may be instrumental in confining the fire.

Overhauling

Overhauling is the elimination of all possible means of a fire rekindling, and the salvage of all articles and property not destroyed. It should be conducted in a manner which will result in the thorough examination of the premises and the complete extinguishment of all fire. A method which will require but one handling, examination or removal of involved materials will expedite the work. Checking avenues of fire travel should include these steps:

1. Examine adjoining buildings, if exposed to the fire.
2. Inspect entire premises, and all arteries through which fire may have traveled.
3. Open up walls, partitions, floors, ceilings, etc., on fire floor and above (Figures 118 and 119).
4. Scrutinize stock for hidden fire.
5. Examine rafters for dust, for this dust will support fire in a smoldering condition and throw off very little smoke.

Firemen should follow these precautions to assure their own safety:

1. If more than one floor was involved in the fire, all hands should be ordered out until the stability of the structure is determined.
2. Examine structural members, for fire may have weakened vital supports to the danger point.
3. Beware of the descent of heavy objects, such as safes or machinery, due to floor failure.
4. Remove accumulated water, floor by floor, beginning with the first, for a large quantity of water may have taxed walls or floors to a point of collapse.
5. If floors are doubtful, stay near the walls or windows until

heavy materials are removed from center.

6. Use helmets and proper fire clothing.
7. Shut off gas, electric, heating, refrigeration and leave restoration to qualified crews.
8. Make holes obvious; place chairs, etc. within same to prevent men from falling through.
9. Do not drop objects from heights to the street or a yard without warning and clearing the way.
10. Exercise care in the use of axes and other overhauling tools.

Efficiency In Overhauling

This will be increased by adhering to these points:

1. Have a plan in advance so that but one handling and one examination will suffice.
2. If the area is large, men should split into groups; work should be started at either end and work towards center.
3. Enginemen, if not otherwise occupied, should help in overhauling.
4. Call Searchlight Apparatus, if necessary.
5. Summon Rescue Company for overhauling where toxic gases are present, or where men are caught in a collapse, or where there is danger of explosion, or when the use of acetylene torches are required.
6. When pulling down burned materials, do not scatter them about.
7. Never cover unharmed stock with burned material or debris.
8. Where unnecessary water damage will not result, have

burned areas and shaftways thoroughly washed down by hose lines.

9. Check up on all tools before leaving.
10. Restore standpipe and sprinkler systems to working order.

Arson Or Sabotage

Where Arson or Sabotage is suspected, Members should protect all evidence of incendiarism. They should call for and cooperate with the Fire Marshal and should avoid discussion of evidence with civilians.

Firemen may assist Members of the Fire Patrol in salvage work after the fire in these ways:

1. Separate the ruined from that which may be salvaged.
2. Avoid unnecessary water damage in washing down. (Use tip on nozzle, or 1½-inch hose line).
3. Use pools of accumulated water or refuse barrels for dipping articles.
4. Secure cooperation of Fire Patrol; additional Patrol units may be summoned, if necessary.
5. When valuables are found, give them to your Commanding Officer. He will then deliver them to the Fire Patrol Officer or to the Police, obtaining a proper receipt.

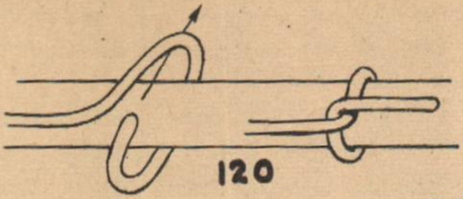
Knots

THE USE OF ROPE IN FIRE DEPARTMENT OPERATIONS HAS long since established its prime importance. Its utility for rescue work, rapid hoisting jobs, lashing hose lines and ladders for security, and numerous tasks incidental to the fighting of fires, makes it imperative that every beginner fireman become thoroughly familiar with all of the practical phases of rope usage and the recognized knots that facilitate and make safe its employment.

It is most essential that all ropes carried be tested frequently. If the rope is frayed or damaged in any way, if its tensile strength has been diminished by age, dry rot, or contact with harmful foreign substances, the place to find that out is at the Fire Station. Certainly not at a fire or other emergency, when a life may hang in the balance, or a sorely needed hose line or ladder is being hoisted to the roof. Loop your roof rope through the wheel of a heavy piece of apparatus so that two free ends of equal length may be grasped by groups of men. Let them exert full strength in trying to snap it. If it breaks, all well and good. It is easily replaced. But if you wait for usage at a fire to discover its frailty, it may be no mere matter of replacement.

Have your rope readily available. Every man on the truck should know where it is. If equipped with reels or spools, have it neatly wound and ready for instant use. If your company is not so equipped, keep it neatly coiled and encircled with its own free end so that it will not uncoil and entangle. Efficiency in the maintenance of ropes may pay large dividends.

Knots recognized by the New York Fire Department have received such official sanction primarily because experience and



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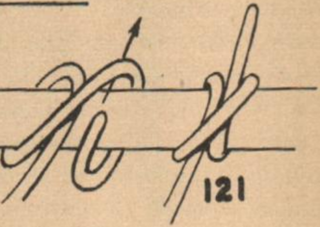

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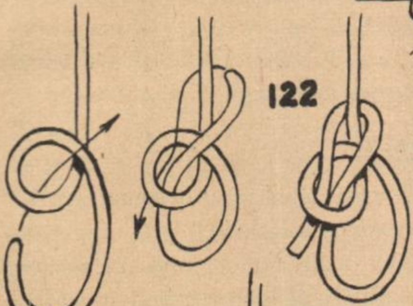

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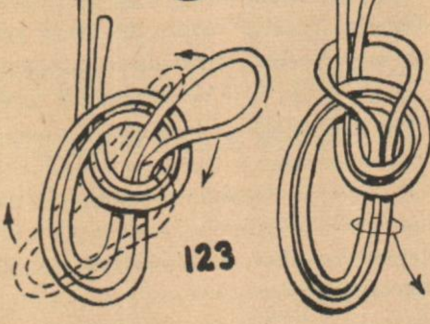

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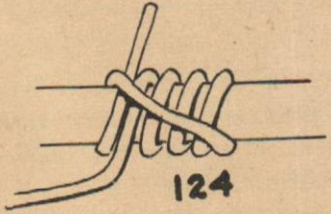

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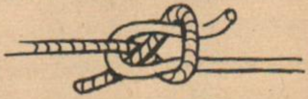

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experimental tests have proved them to be absolutely safe when properly tied. Also because they are relatively simple and provide for uniformity of practice, so that one man's knot is just as easily untied by another man at a remote point.

Study each knot. Follow closely the steps that go toward making it complete. Tie the knot over and over again, yourself, making sure that you have the corrective supervision of a man who does know the knot. Become so well acquainted with each knot that your eyesight plays no part in it. After a while your hands will do the job through force of habit, and the more often you do it, the faster the process becomes. Accuracy is important. And so is speed. Your efficiency and dexterity may be the means of saving a life. And that life, possibly, may be your own.

Half-Hitch. (Figure 120)

Of all knots the half-hitch is probably most common. As the illustration indicates it is extremely simple. In tying the half-hitch, the free end of the rope is brought around the tension end and then brought under itself. It is used not only alone but also in combination with a variety of other knots. In lifting objects such as axes, hooks, extinguishers, and other more or less vertical implements to the roof by means of a rope, the half-hitch is tied about the end of the tool or object which will be facing the roof during ascension, to keep the object vertical and prevent it from continuously striking the building. A half-hitch is used in the Rolling Hitch and in the Bowline-on-a-Bight. Inasmuch as a Clove Hitch is merely two half-hitches with a binder, its use in that knot is obvious.

Clove Hitch. (Figure 121)

The Clove Hitch is merely two half-hitches. It is usually secured with a binder. The strength of this knot depends only upon the strength of the rope. It will not loosen when properly tied. Two half-hitches in a hawser are sufficient to hold a ship to its moorings. It is tied, two feet from the male butt, when a line is to be hoisted from street level to a roof or other high point.

It is used in conjunction with the Rolling Hitch in making this same line secure to a chimney or other substantial object when taken to the roof or other place of height. It is tied about the Strainer and Large Suction when drafting water. It is useful in reducing strain on couplings, as for example when a line is stretched into the first floor outlet of a standpipe due to inoperative condition of outside siamese. It is used in hoisting and bridging ladders and is also tied about tools, extinguishers, etc., at the end that will face the street during ascension, when hoisting same to lofty places.

Bowline. (Figure 122)

This is one of the most useful of all knots. It is also a safe knot. It will not slip, nor will it tighten under tension. Its most common usage is in conjunction with the two Clove Hitches tied about the beams of a portable ladder to be hoisted or lowered. The bowline knot centered between the two beams keeps the ladder vertical during such operations. The bowline knot is generally used to form a loop, especially when the line and loop will be subject to severe strain. This knot, when mastered, will suggest many more applications.

Bowline-On-A-Bight. (Figure 123)

This knot differs from the ordinary bowline in its form of construction, but its characteristics are practically the same. It is one of the most important knots used in rescue work. When tied properly, it may be used to lower a fireman from great height to windows where persons are in danger. It may be used in lowering persons to the street when other means of escape are cut off. It may also be used in lowering a fireman into a hold of a ship, or a sewer, for rescue work. In such instances it is the knot the Department recommends and wants used. It will not jam, and forms a comparatively safe 'cradle' from which the person being lowered cannot slip. Consult Evolution No. 25 for illustration of this knot applied to person's body.

Rolling Hitch. (Figure 124)

The Rolling Hitch (four turns around hose with a half-hitch over all and a binder) is used when a line of hose has been hoisted via outside of the building to the roof or other point of great height. It should be tied beneath the coupling of the hose which is just below the ledge of the roof or sill of a window. The free end of rope, after tying of this knot, must be secured to some substantial object to accomplish the full intent of the operation. Consult Evolution No. 1.

Fisherman's Bend. (Figure 125)

This knot is useful where two loose ends of rope must be joined, and additional security with the increase of tension is desirable. It is a simple knot, and once learned not easily forgotten.

Standpipes and Sprinklers

IN DISCUSSING THESE TWO FIRE PROTECTIVE DEVICES, IT IS WELL to understand the fundamental reasons for the installation of such equipment as well as a general knowledge of the physical make-up of each.

The ordinary method of stretching, where coupled lengths of hose with nozzle affixed are attached to discharge outlet of pumping engine, is designed primarily for use in buildings of moderate height. Existing structures over 85 feet in height and structures hereafter erected to exceed 75 feet in height are required by law to install a Standpipe System to facilitate the work of the Fire Department in fighting a fire on the upper stories. Loss of an entire building may result from delay in getting water on a fire quickly. Manual stretching of lines to points of great height consumes valuable time. The solution, therefore, is the Standpipe System, with sufficient 2½-inch hose present at all times to cover the entire floor area at each story, and water under pressure available to insure prompt streams on any fire that occurs.

Sprinkler Systems, required by law in specified hazardous occupancies, are also designed to get water on a fire in its early stages, but by a different means. Here the process is mechanical. The flow of water in shower effect is from a sprinkler head embodied in a strut, consisting of two parts held together by fusible solder which fails at a pre-determined temperature. Upon failure of the strut, water spouts, strikes a deflector and is scattered. As in the case of a Standpipe, some means of communicating pressure to the water must be provided.

Standpipe Systems. (Fig. 126)

A Standpipe System is a series of vertical and horizontal pipes of wrought iron or steel, with galvanized valves, fittings and connections of cast steel, brass or malleable iron.

Starting from the street, with one or more 2-way siamese inlets equipped with 3-inch female threads, and clapper valves to insure inward flow only, a horizontal run of pipe connects the flow of water fed by pumping engines of the Fire Department from the siamese to the riser. The riser is the vertical run of piping which conveys the water to the upper stories. These risers, or pipes, which run from cellar to roof, must have 2½-inch hose outlets, fitted with gate valves, not over 5 feet from floor level at each story, including the cellar, and a three-way 2½-inch manifold and gate valve at the roof. The number of risers required depends upon the floor area of the building, and there must be sufficient 2½-inch hose connected so that every point of the floor area served is within 20 feet of the nozzle when hose is unreeled. The nozzle provided is of the smooth bore type, not a controlling nozzle. In some buildings, such as office buildings, hotels, club-houses, hospitals, multiple dwellings, etc., the law permits the use of 1½-inch hose instead of 2½-inch hose.

The street siamese connection referred to (painted red) is always mandatory as a means of the Fire Department feeding water to the system, and the number of siamese connections required depends upon the number of risers and the number of streets which the structure faces. Another source of water supply, however, must be present, so that the system can be effectively used even before the arrival of firemen. Such source may be a gravity tank, a pressure tank, or direct connection to a city main. The law insists upon certain qualifications in the use of these various sources.

A standpipe system so equipped then is ready for instant use by the tenants in extinguishing small fires and getting streams into operation before the arrival of firemen, and also as a very

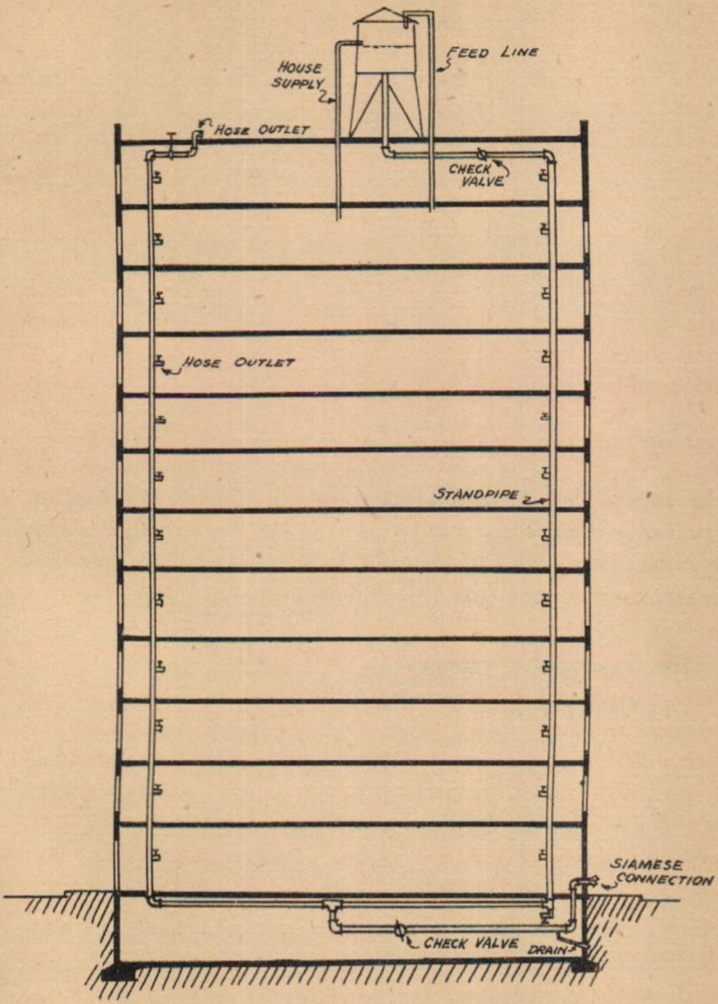

HOUSE SUPPLY
FEED LINE
HOSE OUTLET
CHECK VALVE
HOSE OUTLET
STANDPIPE
SIAMESE CONNECTION
CHECK VALVE
DRAIN

FIG. 126

valuable aid to the Fire Department in getting streams of any desired calibre into action at high levels.

The rules of the Department stipulate that when the fire is on the 5th floor or higher, the first line stretched should go into the street siamese connection. The hose should be 3-inch hose and it should be connected to the discharge gate of a pumping engine, so that a supply of water into the system will be assured. The Department dictates that firemen proceed to the floor below the fire, carrying sufficient 2½-inch hose (rolled up) to cover the entire floor area; detach the house line (because it is not always dependable); then climb one flight to the fire floor and begin extinguishing operations.

Fire Pumps

The Standpipe Law requires that when buildings exceed 250 feet in height, the primary source of water supply must be supplemented. This is usually accomplished by the installation of a Fire Pump. Fire Pumps in buildings are of various capacities. When a building is so equipped, and fire is large enough to warrant their use, get in touch with the engineer or superintendent present, and see that the Fire Pump is put into operation.

Yard Hydrant Systems

In addition to structures of great height, places of great area such as oil storage plants, lumber yards, ship yards, amusement parks, and large industrial plants must be equipped with systems of hose and piping for immediate use in case of fire. A Yard Hydrant System is a system of hydrants (maximum distance between hydrants — 250 ft.) inside an enclosure, directly connected to a city main. Sufficient rubber lined hose, equipped with smooth bore nozzle, is stored in scattered hose houses, with "Fire Hose" in 6-inch letters on the door. If the area served is more than 40,000 square feet or if the city water service does not comply, a gravity tank of at least 50,000 gallons, at an elevated position, must be provided.

Where unusual hazards exist in such yards, monitor nozzles, similar to our deckpipes, but equipped with remote control so that they may be operated from a distance, may also be required.

Standpipe System Valves, etc.

Following is a list of the essential parts of a standpipe system with a brief description of each part.

Siamese Hose Connection (at street level)

Painted red.

Between 18 inches and 36 inches from sidewalk.

2-way inlet, 3-inch female threads.

Fitted with clapper valves.

Connects to riser or cross-connection by means of horizontal piping.

Drip Valve

Located between siamese connection and Straightway Check Valve, to drain section communicating to outside and prevent freezing.

Straightway Check Valve

Located just inside wall of building in the horizontal run of piping, to prevent building water supply from reaching outer air.

Horizontal Check Valves

Installed in the run of each riser continuing into a higher required tank section, to permit all upper sections to be fed from the section below, and to prevent any lower section from being supplied from above.

Riser Control Valves

Provided to permit any riser or other section to be shut off while the remaining risers continue in use.

Hose Outlet Valves

2½-inch hose outlet valves, with wheel for opening and closing supply to attached line.

Pressure Reducing Valve

When normal pressure at 2½-inch outlet exceeds 55 pounds, it shall be equipped with adjustable type pressure reducing valve, so that pressure will remain at 50 pounds.

When 1½-inch hose is used, pressure reducer shall keep pressure at 80 pounds when same exceeds 85 pounds.

(These valves may easily be removed by firemen operating a line from the outlet before connection is made thereto.)

Standpipe Procedure:

1. Fire on 5th or higher floor, first line goes into the Standpipe Siamese. Connect two 3-inch lines so that if one bursts water will still be supplied.
2. Pumper connected to hydrant with large suction.
3. Hose should be laid on same side of street as the building, if practicable, and near the curb. Straighten out all kinks.
4. Do not obstruct entrance to building, nor place hose where it may obstruct ladders.
5. All connections made up spanner tight.
6. If caps cannot be removed from outside siamese, quickly connect to outlet on first floor, using proper fittings, leave man to get the cap off. Open valve on first floor when water is ready to enter.
7. Take sufficient rolled-up lengths of 2½-inch hose to cover entire floor area, together with controlling nozzle claw tool and axe; use elevator if present.
8. Connect rolled-up lengths to outlet of system on floor below fire and stretch line up stairway, leaving the outlet and hose on fire floor for use by Truck, if necessary. This is also a precautionary measure if forced to back down.
9. Station fireman at Hose Outlet Valve to open same when ordered. He should open valve until pressure at nozzle is sufficient.
10. When building is of height that calls for Fire Pumps, get in touch with engineer, and if fire is large enough to warrant their use, put them into operation.
11. If standpipe system is completely out of service, have line

stretched either through elevator shaft or outside building. Bring hose up first, then lower it.

12. If fire is large and much water is to be used, have order conveyed to Pump Operator at street to pump water into system at proper pressure.

Sprinkler Systems

The primary purpose of a Sprinkler System is to get water directly on the fire at the earliest possible moment, even before the Fire Department has been notified. The standard ½-inch sprinkler head discharges about 20 gallons of water per minute. In many cases this is sufficient to extinguish the incipient fire. In other cases, where the sprinkler head is so situated that its spray does not hit the seat of the fire, it nevertheless serves to hold the fire in check until other means of firefighting are brought into action.

In the usual Sprinkler System water is fed to the spaced sprinkler heads through piping, attached to the ceiling. The automatic function of the head is embodied in a strut, which consists of two parts held together by solder. Although some heads are designed to fuse at higher temperatures, the greater majority of them fuse and operate when subjected to 165 degrees (F). A deflector attached to the head converts the stream of water into a heavy spray that spreads over a wide area. This deflector is designed to throw water in all directions, and on an average the ½-inch head covers about 80 square feet of floor area. Definite laws govern the sizes of pipe, the method of hanging the pipe and all other installation details.

The efficiency of a sprinkler system depends upon water delivered in sufficient volume and at proper pressure.

There are three types of Sprinkler Systems:

(1) *The Automatic Wet System*

In this system all risers and pipes are kept full of water under pressure. When the action of heat opens the sprinkler head water flows immediately.

(2) *The Automatic Dry System*

In this system, used in buildings that are unheated during the winter months to the extent that water would freeze, the pipes attached to the ceiling normally contain air under pressure. When a sprinkler head opens, the air escapes and water flows automatically by the operation of a valve.

In both of these foregoing systems, roof tanks or building fire pumps are the usual source of supply.

(3) *The Non-Automatic System*

This system consists of an arrangement of pipes not connected to any permanent source of water supply. It is fed only by means of connections from Fire Department pumping engines.

Regulations in force in New York City require the installation of Sprinkler Systems in occupancies storing such high hazard materials as fireworks, nitro-cellulose products, and motion picture films. in theatres and in factories devoted to spray painting on a large scale. Sprinklers are likewise required in certain other factory buildings over seven stories in height and employing 200 or more persons above the 7th floor. Large buildings of combustible construction, such as non-fireproof business buildings, or those containing large stocks of inflammable merchandise, such as department stores, must be similarly protected. Automatic sprinkler systems may be installed in the hallways and stairways of rooming houses in place of a required secondary means of egress.

Siamese connections at street level, painted green, are provided in all Sprinkler System installations except those referred to in rooming houses, as a means of connection and supply by the Fire Department upon arrival. The New York Fire Department dictates that when a fire building is encountered that is equipped with a Sprinkler System, one of the first lines stretched must be connected thereto. The threads of the siamese connection are 3-inch female, and 3-inch hose, therefore, should be stretched. Like the siamese for a Standpipe System, it is equipped with clapper valves to prevent outward flow.

The effectiveness of Sprinkler Systems is greatly increased when operated in conjunction with an automatic alarm device, which transmits a fire alarm as soon as water flows in the system. The alarm usually registers in the central office of a private corporation devoted to such service, from which it is re-transmitted to the Fire Department Alarm Headquarters by a direct connection. Thus, the human element of discovering fire by smelling smoke and seeing flames is eliminated.

Inasmuch as Control Valves for Sprinkler Systems are sealed in an open position so that the only means for retarding water flow are the fusible sprinkler heads, it is important that such Valves be located when arriving at a fire and sprinkler heads are discharging. This is done so that the system may be shut off when no longer required. Where the area is large or numerous floors are connected to the one Sprinkler System, valves are provided to control limited sections, as well as one main Shut-off Valve. It is imperative that both be quickly located so that there will be no delay in shutting down. Unnecessary operation of heads may cause considerable property damage.

Summing up, then, a Sprinkler System is a system of piping connected to one or more acceptable sources of water supply, provided with devices so arranged and located as to discharge an effective spray over the interior of a building area. For water supply it depends upon any one or combination of two of the following:

1. Gravity Tank.
2. Pressure Tank.
3. Automatic Fire Pump.
4. Direct connection to public water system.
5. Siamese connection (*painted green*) *at street level*, for Fire Department supply.

Perforated Pipe Systems

Many cellars and sub-cellars of factories and mercantile establishments are still protected against fire by a system consisting of perforated pipes fed by Fire Department engines through an outside aluminum painted siamese connection.

Ammonia Mixer Connection

In refrigeration plants and other structures where ammonia is extensively used as a refrigerant, a Fire Department connection at street level, so marked, is provided for emergency use. The purpose of this device is so that the pumping engine may pump water into the refrigeration system and reduce excessive pressure that may be generated by heat. Ammonia gas is readily absorbed by water. One gallon of water will absorb one pound of ammonia. This emergency device permits water to mix with the ammonia, and subsequently drains into the sewer. The Ammonia Mixer Connection, however, should not be used unless fire is in direct communication with the refrigeration plant; not when there is a leak or rupture in pipings of the plant. Ammonia is very expensive, and unnecessary operation of this device would be a costly mistake.

When its operation is imperative, a 2½-inch line should be stretched into the street inlet. Valve box located near the siamese must be unlocked and opened, but the ammonia valves within the box must not be opened before a constant flow of water is running. Water should be supplied constantly until no fire or heat is in the system, and during such time as emergency valves are open. Ammonia valves must be closed before shutting down on supply of water, or else free ammonia will enter sewers.

"Taking Up" Operations

"TAKING UP", IN FIRE DEPARTMENT LANGUAGE, AS IT literally implies, entails the taking up of all hose, nozzles, ladders, tools and equipment used at a fire and transfer of same to their proper places on apparatus, after services at the scene are no longer required.

As in every other phase of firefighting, efficiency of operation simplifies the task at hand, no matter how arduous. When a fire has been extinguished and overhauled, and the order has been given by the Officer in Command to "take up", there are a number of points that must be given careful consideration. A brief listing, numerically, with some attention to proper sequence, may be of value. It should be borne in mind that "taking up" is by no means a leisurely operation. Each action should be carried out briskly, and every effort directed toward getting the company back again in service without delay.

1. Each man of a company, with the exception of the Motor and Pump Operator, should report to his immediate superior officer when the order to "take up" is given, so that the officer may account for his entire crew and assign them to specific duties.

2. The fireman so ordered should convey the "take up" order to the Pump Operator.

3. If the Pump Operator has been operating the lines from a High Pressure Hydrant, he shall shut off the independent valves of the hydrant supplying same, then shut off the main valve. Where the High Pressure Gauge has been employed, this may be used to drain the line.

4. If the Pump Operator has been operating the lines from a pumping engine, he shall disengage the pumps and open up the drain. The accelerator should be so retarded that the motor may properly idle while hose is being placed back on the apparatus.

5. Hose lines being taken up at a fire shall be uncoupled outside the building at a point between pumping engine or hydrant and entrance to building, so that the line may be drained of water at the curb.

6. The line should be backed down and out from the building, the man with the nozzle end being last to leave. The nozzle should remain affixed to the hose, in a closed position, until reaching the street. It should be removed there to facilitate draining.

7. Hose lines should be disconnected from the discharge gates on the Pumping Engine.

8. Before being placed on the apparatus, the hose shall be recoupled so as to be ready for use in any emergency.

9. The Hydrant Connection or Large Suction, whichever was used, should be disconnected from hydrant and pumper inlet, drained and replaced in its proper position on the apparatus.

10. Whenever a fire hydrant is used by an Engine Company during the period from November 1st to April 15th, the Officer in Command of said Company shall, before leaving the scene of the fire, see that no water is allowed to remain in the barrel of such hydrant. If the hydrant does not drain properly, the water in the barrel shall be pumped out.

11. After a fire hydrant has been used, the cap shall not be replaced until the water in the barrel has fully drained. The placing of the cap on the hydrant before the water has completely drained tends to create a vacuum, thus

preventing proper drainage.

12. Hydrants left in an inoperative condition shall be so marked by means of a hydrant disc.

13. Engine Companies shall carefully check up on all hose lengths removed from their apparatus, also on all tools, fittings, hose tags, and other equipment in use at the fire, and return same to their proper places.

14. Hook and Ladder Companies shall check up on all ladders, tools and other equipment employed and see that same are returned to their proper places on the truck.

15. Hook and Ladder Company last to leave shall, before returning to quarters, see that fire escape ladders and counter-balanced stairways are placed in proper position.

16. It is the duty of the Officer in Command of the Engine Company that was first to arrive at the fire to re-wind and re-set the Fire Alarm Box that transmitted the alarm.

17. If the Standpipe or Sprinkler Systems have been in operation, same should be left in an operative condition, ready for immediate use.

18. When firemen have closed any control valves of a sprinkler system, the Battalion Chief 1st due shall, where a representative of the Fire Patrol is not present, notify the Engineer, Superintendent or other person in charge of the premises that such valves have been closed and that fused sprinkler heads should be replaced. If unable to notify any of the latter persons, such Officer shall assign a Fireman to the premises until the sprinkler system is again placed in operative condition. Where the sprinkler system is otherwise damaged to such an extent that it cannot be repaired within a reasonable length of time, the assigning of a fireman shall be dispensed with. In

the event that the Battalion Chief 1st due is not present, the foregoing duties shall be carried out by the Officer in Command of such fire or emergency.

19. Building Superintendent or Engineer should be notified of any standpipe hose that has been found defective.

20. Building Superintendent or Engineer should be notified of the use and need for recharging of privately owned fire extinguishers.

21. Every effort should be made to guard against injuries to tenants or employees of the building, by closing elevator shaft doors, making holes in floors obvious, etc.

22. Building Superintendent or Engineer should be notified if the glass on a Class 3 Building Box has been broken in transmitting an alarm, so that same may be replaced.

23. When the conditions surrounding a fire are of a suspicious character, the Officer in Command shall immediately notify the Fire Marshal, by telephone, and place a fireman in charge of the scene with instructions to prevent the disturbance of anything connected therewith. Firemen so assigned shall refrain from any discussion of the fire. They shall note the actions of persons entering the premises, which actions shall be reported to the Fire Marshal upon his arrival.

24. When backing apparatus out from positions maintained at fires extreme care should be exercised. Members should take positions in the roadway, particularly to the rear of apparatus so that collisions and other accidents may be avoided. Where backing out entails entrance into an avenue or other thoroughfare with fast moving traffic, it may be advisable to avoid the risk by making a complete circuit of the block.

25. Unnecessary speed in driving apparatus back to quarters should be avoided. It must be kept in mind that the

company is not responding to a fire, and extreme precautions observed to avoid accidents.

26. When returning, do not use one-way streets against traffic.

27. When a fire is encountered while returning to quarters, apparatus should stop to extinguish same, and no signal to the Dispatcher is required unless a full first alarm assignment is required. In that case, the 2-2-2 signal for each company that has stopped is transmitted, followed by the 7-5—Box signal.

28. Upon return to quarters, and the company is again ready for response, the "In Service" taps are transmitted to the Dispatcher by use of the Morse Key. (4-4-4—Company Number for an Engine Company; 4-4-4—Preliminary 7 and Company Number for a Truck.)

29. Care of hose, apparatus and equipment, upon returning from fires, is of vital importance. This topic is discussed in chapter dealing with Duties at Fire Station.

Gas Masks

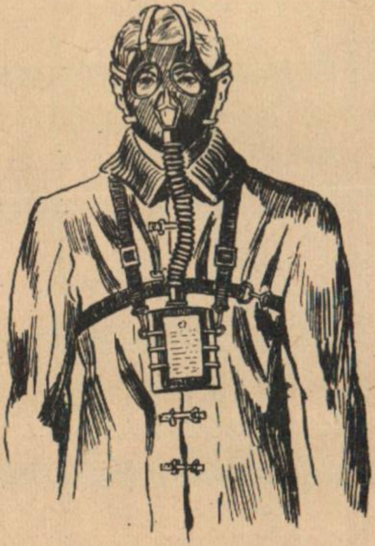
GAS MASKS ARE CONSIDERED AN IMPORTANT ASSET IN RESCUE work. In their ordinary routine of work men assigned to Rescue Companies descend street sewers to save the life of an employee overcome by deadly sewer gas. They penetrate the poisonous atmosphere of a refrigeration plant to shut off the flow of gas and carry those felled by the gas to the outer air. They search a cellar, slowly smoldering with fire, for other firemen "knocked out" by the carbon monoxide present. In each case they must be equipped with the proper mask for the existing condition.

Fire Department use of gas masks, in recent years, has extended beyond rescue work. With the development and almost universal use of electric refrigeration, mechanical failure often occurs, permitting the escape of noxious gases. Firemen don masks to ventilate the premises and to manipulate controlling valves. Again, mask-protected firemen may enter a burning structure, heavily charged with smoke and the ordinary gases of combustion, and quickly get to the seat of the fire without undue injury to themselves.

It is not practical for firemen to wear masks in extinguishing an ordinary fire. In such conditions a man in a mask is only 50% as efficient in work accomplished as a man without a mask.

Briefly then, masks are used to permit effective operations in atmospheres where such work would otherwise be impossible. It permits work in tunnels, ducts, subways, refrigerant leaks, manholes, holds of ships, and other places where toxic and lethal gas may be present in heavy concentration.

It is advisable that firemen equipped with masks enter the involved building in pairs, if possible. Each man should have a



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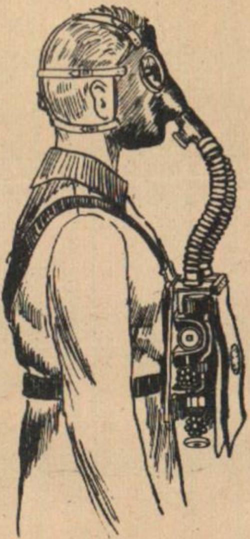

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line attached to his belt in order that he may find his way back to the open air.

Gas Masks, as used in Fire Department work, are grouped in three main classifications: Canister Masks, Self-contained Oxygen Breathing Apparatus, and Hose Masks. The construction, uses and limitations of each type will be discussed.

Canister Masks. (Fig. 127 and 128)

A Canister Mask permits the wearer to breathe poisonous gas-laden air through chemical and mechanical filters that purify it of its harmful ingredients. Industrial Canister Masks, giving protection against one particular gas, such as ammonia, chlorine, or sulphur-dioxide, are used where the nature of the hazard is invariably the same. But in a large city or in a district housing an assortment of special-hazard plants, firemen are never certain of the danger to be encountered. Trouble comes not only from such familiar hazards as refrigeration or chemical plants. Very often fire in a small store with an innocent stock of plastic novelties, dry-goods or shoes, will result in many gas casualties. Firemen, therefore, must be guarded against many poisonous gases and fumes.

The All-Service Canister Gas Mask

This mask gives protection against carbon-monoxide, ammonia and many other gases. It fills the need just mentioned. It filters carbon particles suspended in the atmosphere of a smoke-charged area. It can be used in any condition where there is at least 16% oxygen, sufficient to support life.

The mask consists of a rubber face-piece with built-in goggles for vision, a short piece of flexible rubber hose, and the canister that is strapped to the body by means of a shoulder harness. Atmosphere enters through an opening at the bottom of the canister, passes through layers of chemicals and the flexible hose to the face-piece. The wearer exhales through a small rubber valve set in the face-piece.

The Canister contains eight layers of different chemicals, each designed to filter smoke or absorb certain types of gases from the air passing through. A dial indicates when the layers have absorbed the limit of their impurities. The wearer should watch this dial from time to time and when the needle reaches the danger mark, he should accept the warning and leave the gas-filled area. The Canister mask gives two hours service, and its canister may be replaced.

It is vitally important that the wearer of the All-Service Mask realize that the Canister is only a filter and does not supply oxygen. It will afford no protection in an atmosphere deficient in oxygen. Wherever fire is burning, firemen know that there is enough oxygen, otherwise the fire would be smothered.

Before actual use in a gaseous atmosphere the mask should always be tested by shutting off the inlet at the bottom of the canister with the palm of the hand and inhaling. If the face-piece collapses it is air-tight and fit for use.

The mask should be removed from the face only when the wearer is clear of the affected portion of the building.

Care of the mask includes these important instructions:

1. All connections should be tightened to prevent leakage around the gaskets.
2. After use, the mask should be disconnected from the canister, washed in a disinfectant solution, then hung until perfectly dry.
3. The mask should be stored in a dry place.
4. The inlet of the canister should be sealed with adhesive tape when not in use.

All-Service Canister Masks are carried by all rescue units and on every chief's car.

Self-Contained Oxygen Breathing Apparatus

This device enables the wearer to be entirely independent of outside air. Oxygen from a high pressure cylinder is fed, through a mechanism, into a breathing bag. The wearer breathes from this supply. Before the breath which is exhaled returns to the breathing bag, it first yields its carbon dioxide content to absorbent chemicals and passes through a cooling chamber. Since the apparatus does not filter the surrounding atmosphere, the respiratory system of the wearer is fully protected from any concentration of poisonous gases. The quantity of oxygen fed to the breathing bag is automatically controlled to the amount required by the composure or exertion of the wearer. This is done by a small valve that works on the rise and fall of the bag.

Its heavy weight, limiting the efforts of the wearer, is a disadvantage of this type of mask.

The supply of oxygen in the tank must be carefully watched. In penetrating a dangerous atmosphere, oxygen must be saved for the trip out.

Rescue units carry two types of oxygen breathing masks: the McCaa, designed for 30 minutes use, and the Draeger, intended for 80 minutes service.

Hose Masks

This apparatus consists of a face-piece almost identical to the one on the oxygen breathing mask, long, flexible and non-collapsible hose, and a manually operated air pump. Equipped with this device, a fireman working in an atmosphere of smoke and gas receives a supply of fresh air from the outside through the length of hose, penetration into a building, of course, being limited to the length of the flexible hose.

This type of mask is carried only on rescue units.

First Aid

BECAUSE OF THE HAZARDOUS NATURE OF HIS WORK, A FIREMAN is likely to face more conditions requiring a knowledge of First Aid, than the ordinary civilian. Therefore, he should be familiar with at least the fundamental principles of First Aid and with the special treatment of those injuries that are most apt to occur at fires and similar emergencies.

This brief chapter is not intended to replace the 20-hour Standard Course in First Aid, approved by the Red Cross and currently being taught in fire quarters throughout the City. Every fireman should enroll, if possible, for this fundamental course and practice in detail the precepts herein outlined.

Definition

First Aid is sometimes defined as the bridge between the accident and the doctor. It is the immediate and temporary treatment given in cases of accident, or sudden illness, before professional medical services can be obtained. The important point stressed here is that the First Aid worker should not consider himself as the doctor.

General Directions

There are ten steps which should be carried out in almost all cases of First Aid. The steps are arranged in the order of their importance, but, in a specific case, common sense should suggest the best sequence under the circumstances. In fact, many of the steps can be executed at the same time.

1. Give immediate treatment for serious bleeding, stoppage of breathing and poisoning.

2. Send a responsible person to summon a doctor, instructing him to inform the doctor of the location of the accident and the nature and extent of the injuries, and what is being done for the patient.
3. Be careful that nothing is done to aggravate the injury or cause further injuries.
4. Keep the patient warm, comfortable and, if possible, cheerful.
5. Keep the patient lying down.
6. Examine the patient for further injuries that may not be discovered at first.
7. Keep crowds away to avoid excitement of the patient.
8. Apply stimulants except in cases where they do more harm than good, such as serious bleeding, internal bleeding and fractured skull. Liquid stimulants should not be given to unconscious persons.
9. Avoid letting the patient see his injuries and, in severe cases, do not let him know the extent of them.
10. Apply splints to fractures in arms or legs should it be necessary to move the patient.

Shock

By the term "shock" is meant a condition in which all body activities are greatly depressed or slowed down. This condition is sometimes called collapse or prostration. The blood does not circulate properly; the brain and heart are left with an insufficient supply of blood. Shock is frequently the cause of death.

Symptoms

The patient's face is pale. He may take little interest in what goes on about him. A cold sweat covers his forehead and palms of hands. The pulse is rapid, but weak. Nausea and vomiting are common. Breathing is shallow and irregular. He is apt to be "glassy-eyed" and extremely cold.

Treatment

All First Aid cases suffer from some degree of shock, even though all the symptoms may not be present. Hence, treatment should always be given. If the shock is severe, summon a physician at once. In any case, follow these principles:

1. Heat is the most important need of the patient. In applying heat, care must be taken to cause no burns. He should be wrapped in blankets or rugs. Covering the patient on top is not sufficient; he must be kept warm underneath as well. Hot water bags or approved chemical bags may be used to supply heat.
2. Keep the patient lying down with the head low and the feet elevated slightly. This eases the strain on the heart and assists, by gravity, the return of the blood to the head. If it is necessary to move him, keep him in a horizontal position.
3. Stimulants may be given. Aromatic spirits of ammonia, hot coffee or tea, cocoa or milk are all good. Do not give a stimulant in cases of severe bleeding, whether internal or external, or in the case of a fractured skull, until the bleeding has been checked. Do not attempt to make an unconscious person drink.

Burns

Burns are injuries that result from contact with heat. Obliged to face fire in their every-day job, firemen are exposed to these injuries. An explosion, a back-draft, flames darting out unexpectedly, closing in to extinguish a fire, frequently cause serious burns that require treatment. Victims trapped within a burning room or building, often need First Aid attention upon their release. Hence, this topic is one of vital importance to firemen.

In addition to direct contact with flames, burns may be inflicted by certain chemicals, by friction, for example with a rope, by electricity. If the burn is caused by a hot liquid, it is known as a scald.

Degrees

Burns are classified according to the degree or depth to which body tissue are injured as follows:

1. First Degree—Skin reddened.

2. Second Degree—Skin blistered.
3. Third Degree—Deeper destruction, charring and cooking.

Treatment

The dangers from burns are chiefly shock and infection. In cases of first degree burns, any good burn ointment, vaseline, bicarbonate of soda or even cool water may be used.

In second and third degree burns, the danger of infection is imminent. Only sterile materials should be used and any of these remedies may be applied:

1. Tannic Acid, either in the form of a jelly that is spread on with sterile gauze, or as a 5 per cent Tannic Acid Solution in water that is usually sprayed on the affected parts.
2. Picric Acid gauze that has been dried and sealed in packages. Before using the gauze, moisten it with clean, warm water.
3. A home-made remedy such as three teaspoonfuls of bicarbonate of soda (baking soda) in a quart of luke warm water that has been previously boiled (or any clean water, in an emergency). Use neither cotton nor iodine on any burn. Blisters should be opened by a doctor only. If the removal of any clothing is necessary to treat the burn or prevent infection, it should be done gently so as not to disturb any adhering sections of skin. Air should be excluded from the burned parts as soon as possible by means of one of the above First Aid treatments.
In cases of severe burning, shock treatment should be applied and medical assistance should be summoned.

Smoke Asphyxia

Asphyxia is the loss of the power to secure a continuous supply of fresh air. It is frequently caused by gas poisoning, electric shock, drowning or by excessive pressure on the chest. But within the experience of the fireman, the most common cause of asphyxia is from the smoke and gases encountered at fires.

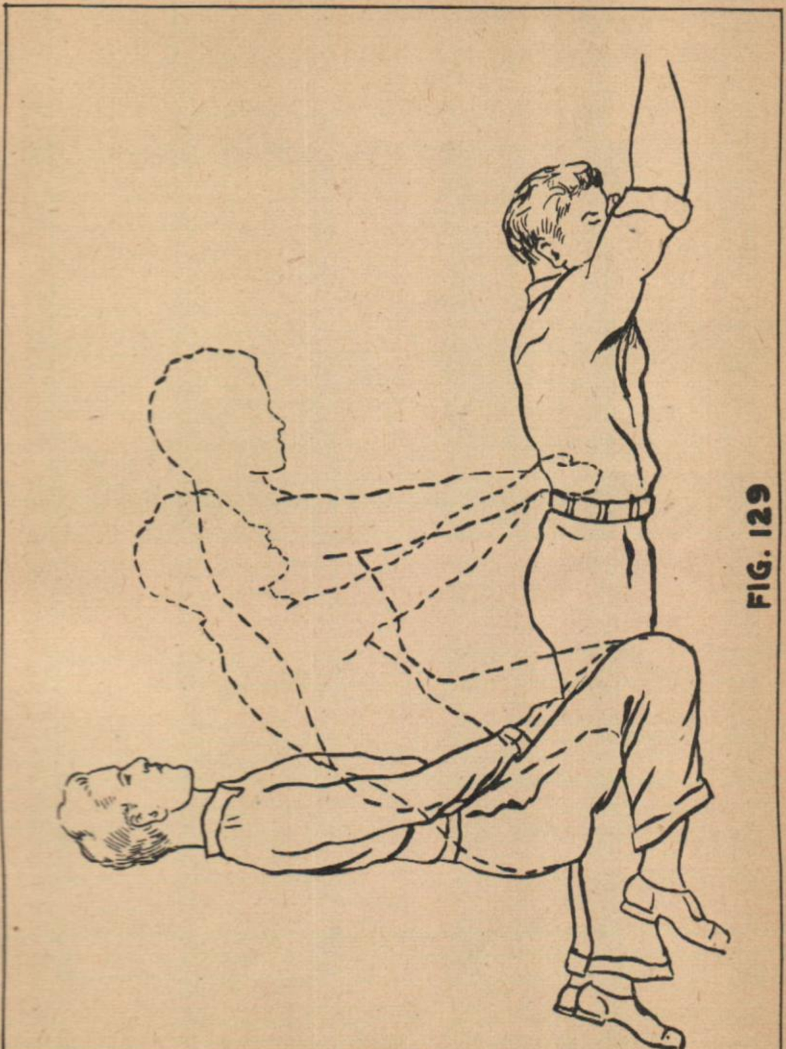


FIG. 129

Artificial Respiration (Fig. 129)

The first treatment for asphyxia is to remove the patient from the cause of the condition. A victim overcome by smoke, therefore, should first be taken to a place where he can obtain fresh air, or at least carried away from the heavily charged atmosphere. Without stopping to loosen the patient's clothing, begin artificial respiration, following this standard technique:

1. Lay the patient on his belly, one arm extended directly overhead, the other arm bent at elbow and with the face turned outward and resting on hand or forearm, so that the nose and mouth are free for breathing.

2. Kneel, straddling the patient's thighs, with your knees placed at such a distance from the hip bones as will allow you to assume the position as shown in Figure. Place the palms of the hands on the small of the back with fingers resting on the ribs, the little finger just touching the lowest rib, with the thumb and fingers in a natural position and the tips of the fingers just out of sight.

3. With the arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing. Do not bend your elbows. This operation should take about two seconds.

4. Now immediately swing backward so as to remove the pressure completely.

5. After two seconds, swing forward again. Thus repeat unhurriedly, twelve to fifteen times a minute, the double movement of compression and release, a complete respiration in four or five seconds.

6. Continue artificial respiration without interruption until natural breathing is restored, if necessary, four hours or longer, or until a physician declares the patient dead.

7. As soon as artificial respiration has been started and while it is being continued, an assistant should loosen any tight clothing about the patient's neck, chest or waist. KEEP THE PATIENT WARM. Do not give any liquids whatever by mouth until the patient is fully conscious.

8. To avoid strain on the heart when the patient revives, he should be kept lying down and not allowed to stand or sit up. If the doctor has not arrived by the time the patient has revived, the patient should be given some stimulant such as one teaspoonful of aromatic spirits of ammonia in a small glass of water, or a hot drink of coffee or tea, etc. The patient should be kept warm.

9. Resuscitation should be carried on at the nearest possible point to where the patient received his injuries. He should not be moved from this point until he is breathing normally, of his own volition, and then moved only in a lying position. Should it be necessary, due to extreme weather conditions, etc., to move the patient before he is breathing normally, resuscitation should be carried on during the time he is being moved.

10. A brief return of natural respiration is not a certain indication for stopping the resuscitation. Not infrequently the patient, after a temporary recovery of respiration, stops breathing again. The patient must be watched and if natural breathing stops, artificial respiration should be resumed at once.

11. In carrying out resuscitation, it may be necessary to change the operator. This change must be made without losing the rhythm of respiration. By this procedure no confusion results at the time of change of operator and a regular rhythm is kept up.

Wounds And Bleeding

A wound is a break in the surface of the skin. In fire-fighting, wounds usually result from contact with broken glass or jagged tin, from sharp pieces of wood or protruding nails, or from falls.

Bleeding may be either internal or external.

Internal bleeding consists of the escape of blood trom blood vessels inside the body. First Aid in such cases should be limited to keeping the patient warm and lying him down, with the head and shoulders raised and the knees bent. He should be taken to a hospital without delay.

External bleeding results from wounds which may be divided into four types:

1. Abrasion—caused by rubbing or scraping.
2. Incised Wounds—A sharp cut caused by a knife or a piece of glass.
3. Lacerations—Caused by a blunt instrument as a piece of heavy machinery.
4. Punctures—Caused by a penetrating instrument such as a nail or a bullet.

Treatment

The First Aid treatment of wounds varies depending whether the bleeding is mild or severe.

Mild Bleeding

In these cases, the chief danger is from infection, and the following procedure is recommended:

1. Use only sterile gauze. Do not touch the wound with the hand or any soiled material.
2. Do not wash the wound with soap and water as such action may introduce germs into the wound. Ordinary dirt should be removed with rubbing alcohol; grease and oil should be removed with benzine, naphtha or turpentine.
3. Apply iodine well into the wound and on the skin around

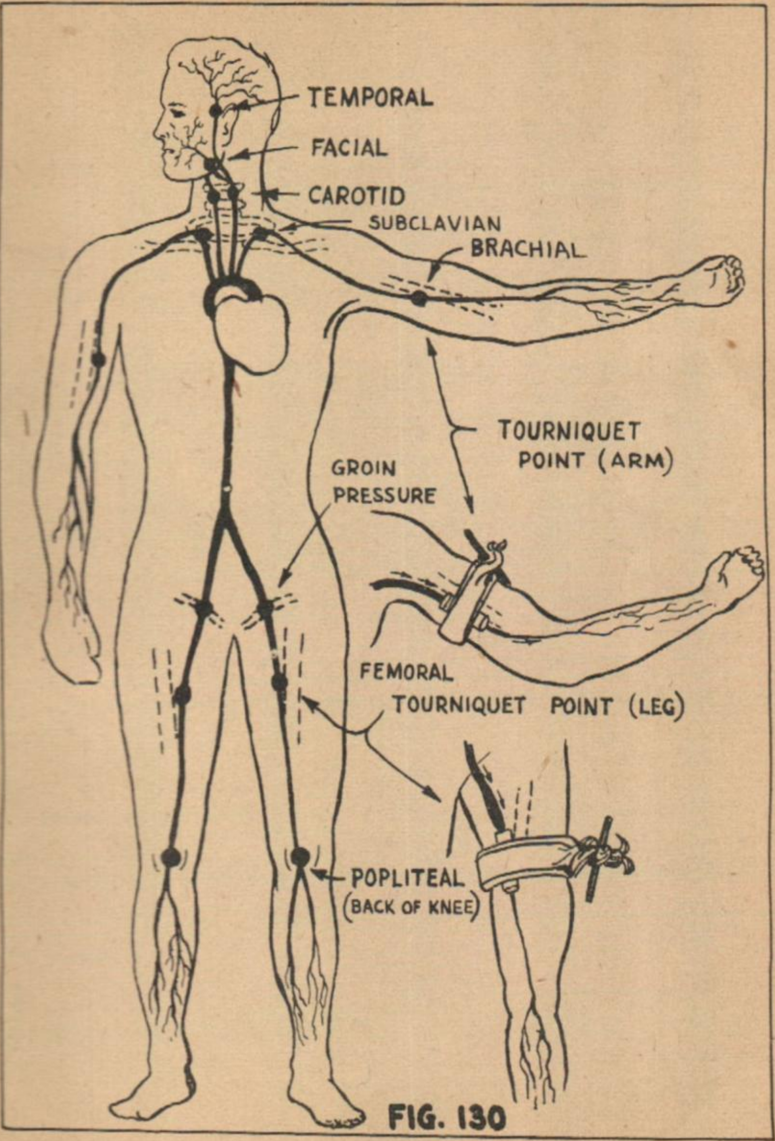

TEMPORAL
FACIAL
CAROTID
SUBCLAVIAN
BRACHIAL
TOURNIQUET POINT (ARM)
GROIN PRESSURE
FEMORAL
TOURNIQUET POINT (LEG)
POPLITEAL (BACK OF KNEE)

FIG. 130

the wound. Mild tincture of iodine, a solution of 2 per cent iodine in alcohol is sufficiently strong for First Aid use.

4. Let the iodine dry to avoid complicating blisters.
5. Apply a sterile dressing or compress and bandage in place. Pressure applied directly on wound with a compress sometimes is sufficient to stop the flow of blood.

Severe Bleeding (*Fig.* 130)

The chief duty of the First Aider in these cases is to stop the bleeding at once. He should first think of pressure. Finger pressure may often be successfully applied on the principal pressure points located as follows.

1. Near the front of the ear.
2. At the pit of the jaw bone.
3. On the side of the throat.
4. In the recess of the collar bone.
5. At the biceps.
6. At the groin.
7. A hand-breadth below the groin.

These pressure points are on each side of the body, making 14 points in all.

At these points of the body, the arteries are just above a bone, so that pressing against the bone shuts off the circulation of the blood below or above that spot.

Arteries And Veins

Arteries carry blood from the heart to the various parts of the body. Arterial bleeding, due to the pumping of the heart, comes in spurts. In such a case, apply fingers to the pressure point closest to the wound, so that the *pressure is between the wound and the heart.*

Veins carry the blood from the remote parts of the body back to the heart. Venous bleeding comes in a steady stream. Finger pressure should be applied so that the *wound is between the heart and the pressure point.*

Tourniquets

This is a mechanical means of applying pressure in very severe cases of bleeding. A flat band of cloth is placed around the wound and a half-knot is tied. A stick is placed on the half-knot and a square knot is tied over it. Twisting the stick tightens the cloth, thereby stopping the flow of blood. A Tourniquet is always dangerous because of the possibility of gangrene setting in from stopping the circulation of the blood. It should not be used if the bleeding can be otherwise checked; if one is used, loosen it every 15 minutes, without removing it.

Final Step

When a severe bleeding condition is controlled, a mild tincture of iodine may be applied, allowed to dry and a sterile compress placed over the wound.

Shock is present in all cases of serious bleeding. It should receive prompt treatment as soon as the bleeding is controlled. However, no stimulants are to be given until the bleeding has completely stopped.

Fractures

A fracture is a broken bone. Many accidents involving this type of injury happen to firemen and to the occupants of burning buildings. Falls off ladders and walls, through unsuspected holes and fire-weakened flooring, falling objects such as beams and sections of masonry are only a few of the causes. Fractures are classified as follows:

1. Simple Fractures:	The bone is broken, but there is no connecting wound from the break in the bone to the skin.

2. *Compound Fractures*: The bone is broken, and in addition, there is a connecting wound from the break to the outside of the body. Either the bone pierces the skin or an open wound leads down to the location of the break. In compound fractures, the great danger is infection.

Treatment

Even if a fracture is only suspected, the First Aider should treat the patient as if the fracture were definitely present. These precepts should be followed:

1. Handle the patient as little as possible and, even then, with extreme care. Careless handling can change a simple fracture into a compound fracture.
2. Severe bleeding should be controlled by the method outlined in the treatment of that subject.
3. Treat the victim for shock, remembering that the essentials are heat, position and, except where bleeding is severe, stimulants.
4. Place the limb in as natural a position as is possible. Do not attempt to replace a protruding bone or to set a broken bone.
5. Make the patient lie as quietly as possible until the arrival of a doctor.
6. If it is absolutely necessary to move the patient from the scene of his accident, splints must first be applied to hold the broken bones firmly in position.

Splints may be improvised from thin, flat pieces of wood, broom handles, umbrellas, folded newspapers, etc. They should be tied in position by folded triangular bandages, scarves, handkerchiefs, ties, belts, etc. A detailed discussion of the subject of splints, covering their construction and application to special types of fractures, cannot be adequately treated here, but should be studied in a standard First Aid Course.

Incendiary Bombs

SINCE, IN THE EVENT OF AN AIR RAID, ALL FIREMEN, BEGINNERS and veterans will be expected to help extinguish incendiary bombs and their resulting fires, it is vitally important that they understand the characteristics of the principal types of incendiary bombs now in use.

In modern warfare, the chief objective of "bombers" is to cripple and, if possible, completely destroy factories, industrial plants, shipyards, granaries—anything, in fact, that is essential in keeping an army in the field and a navy afloat. In accomplishing this aim, experience teaches that incendiary bombs, that is bombs that cause fires, are even more destructive than explosive bombs. The purpose of this chapter is to explain the nature of incendiary bombs and the approved methods of dealing with them.

Electron Bomb

Description: (*Figure* 131)

The most common and effective incendiary bomb of the present war is known as the Electron or Magnesium Bomb. It weighs slightly over two pounds and is in the shape of a tube, 14 inches long and 2 inches in diameter. The casing is made of an alloy of magnesium, known as Electron or Dow Metal, with a small amount of aluminum. One end consists of a vaned tail, 5 inches long, to steady the bomb in flight. The priming composition of the tube is Thermite, that is, a mixture of aluminum and iron oxide, commonly used in commercial welding. A percussion cap for igniting the bomb is usually set in the nose of the tube. The lower part of the casing is ringed with a circle of small *holes to allow the escape of intense flames and facilitate the* spread of fire.

How it Works

On striking a hard surface, a small needle pierces the percussion cap, causing it to ignite the priming composition of Thermite, emitting streams of fire from the small vent holes. The charge of Thermite burns for almost a minute at a terrific heat measured at 4500 degrees (F.) This serves to melt and ignite the magnesium wall of the bomb, which continues to burn in molten form at 2400 degrees (F.) for an additional 15 or 20 minutes, setting fire to flammable articles within the radius of a few feet.

The type of Electron Bomb originally used in the present war did not explode. Firefighters and ordinary citizens were quick to sense this fact and approached the bomb without any hesitation with their extinguishing devices. To discourage this practice and to give the bomb ample time to start a fire, the enemy has lately included a small explosive charge in the bomb that goes off usually within two minutes after impact. It is important that firemen realize this point, so that they may exercise caution in the early stages of the bomb. They should approach the bomb behind the shielding protection of an upturned table. (Fig. 132)

Method of Attack

The light weight of the Electron Bomb gives it a decided advantage over bombs of the heavy type. The average bombing plane has a load capacity of 4000 pounds; it can carry, therefore, only eight high explosive bombs of the 500-pound type that are commonly used to attack vital industrial centers and other military objectives, even the smaller bombs, weighing from 25 to 100 pounds are limited by the plane's capacity. But a single bomber can carry nearly 2000 of these small incendiary bombs.

This advantage is not as great as it seems on first sight. The bomb has a decided disadvantage in not being suitable for accurate aiming. The bombs are seldom dropped individually. The usual method is to enclose 20 to 50 bombs in a basket-like

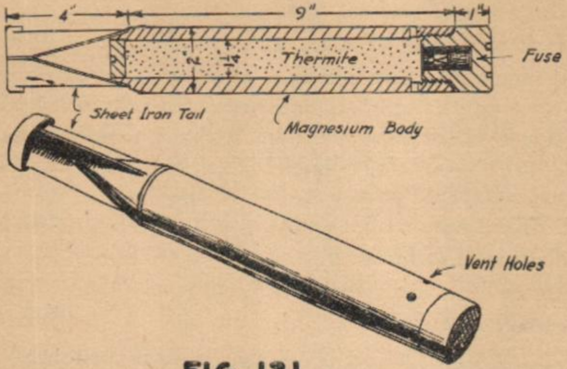


FIG. 131

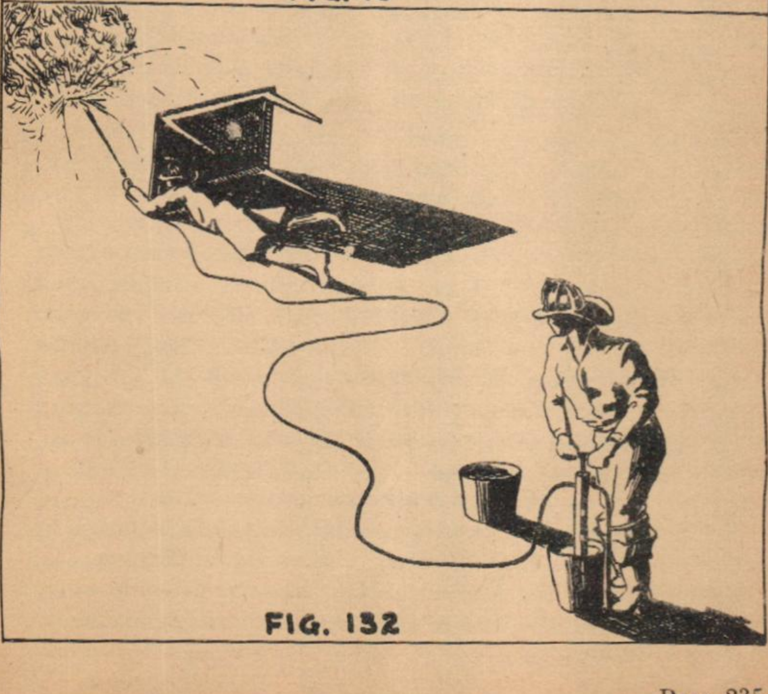


FIG. 132

container which opens when about 100 feet above the ground and sprays the bombs over an area of 200 square feet.

The silence with which a Magnesium bomb works makes it more formidable. It is often not discovered until it has started a fire. During a raid, with high explosive bombs striking their targets with a deafening roar, the thud of a small bomb piercing a roof and landing on the floor below is hardly heard. In burning, the bomb makes only a hissing sound. That is why these bombs caused such widespread damage when they were first used in England. This danger will be eliminated, in great part, by the vigilance of roof watchers.

Effectiveness of Bombs

Each individual bomb will not cause a fire. New York City is not a solid target of buildings. There are streets and wide avenues, parks, vacant lots and bodies of water, where a burning bomb will do no material damage. Taking the city as a whole, it has been estimated that about 15 percent of its area is built up. Accordingly, for every six bombs dropped, one might be expected to strike a building. The other five would fall in vacant areas. If the full capacity of one average sized bomber, 2000 bombs, were discharged over an area, following this reasoning of 15% effectiveness, 300 bombs will hit structures. Some of these, hitting a hard surface, will fail to penetrate. Others will glance off vertical walls and slanting roofs. Still others will land on strong roofs but will not burn through. Experts estimate that about 150 actual fires, varying in seriousness, will result. If the plane proceeds at the uniform speed of 200 M.P.H., at an altitude of 5000 feet, and releases its bombs at the rate of 20 per second, it will discharge its full load in approximately 6 miles. Fires, therefore, will be set from direct hits at intervals of 60 yards.

Note, however, that these figures are based upon the effect of a single plane. If a fleet of planes, or even several bombers, take part in the raid, the number of fires becomes proportionately larger. This point is the primary reason for the need of an Auxiliary Fire Corps.

No peace-time Fire Department, with its ordinary complement of men and equipment, could ever cope with so many fires burning at the same time. As proven by London experiences, more reliance can be placed upon a combination of regular and auxiliary personnel and equipment.

A second caution must be pointed out so that too great confidence will not result from these figures. The 15% estimate of effectiveness applies to the five boroughs considered as one unit. However, if an attack is concentrated upon such high hazard centers as the Brooklyn waterfront, the mercantile sections of lower Manhattan or the crowded residential areas that exist in every borough, a greater number of direct hits must be anticipated.

Controlling Fires Caused by Bombs

The most essential action in fighting fires caused by the Electron Bomb is to tackle the condition as soon as possible after the bomb has struck. Thus, an incipient fire will be checked before it grows to such a size as to require extensive Fire Department operations.

The experience of cities subjected to attack by incendiary bombs teaches that water is the best available means of extinguishing these fires. It is plentiful, is familiar to the average citizen, and if applied with a few simple precautions, is very effective.

When a bomb has penetrated a building, two actions are immediately necessary:

1. To confine and extinguish the fire in combustible materials caused by the bomb.
2. To extinguish the bomb itself and prevent molten metal from filtering through cracks in the floor to the story below where it may start a second fire.

Water will not extinguish the bomb but will cause it to burn out in a shorter period of time. Instead of continuing to burn for almost 20 minutes, the fire will last from mere seconds to 3 minutes, depending upon the quantity of water used. The magnesium will draw the oxygen necessary for burning from the water instead of from the air and hence, its combustion will be accelerated.

Method of Applying Water

Early instructions for dealing with an incendiary bomb directed that water be applied in the form of a spray on the bomb itself, reserving the use of a solid stream for incidental fires and for wetting down the surrounding area. This caution was based on the fear that if too large a quantity of water struck the molten metal, a damaging explosion would result.

However, new instructions calling for a jet, that is a solid stream, instead of a spray in fire bomb fighting, were recently issued by the Office of Civilian Defense. The change in recommendations resulted from exhaustive research by O.C.D. technicians and by the Chemical Warfare Service of the U. S. Army.

The new advice differs in three important points from that formerly issued. The use of a jet or solid stream of water on the bomb itself, rather than a spray of water, is now recommended. The value of sand for fighting incendiaries is minimized and speed is urged in attacking the bomb with a jet as soon as it falls, rather than waiting for the thermite reaction to be completed or for a burster charge to go off. This method has also been adopted in Britain and in New Zealand.

Reduced to essentials, the new instructions follow:

1. Bring your fire fighting equipment to the scene as soon as the bomb strikes.
2. From a distance of at least 8 feet from the bomb, shoot a jet of water directly at the bomb without delay, to put it out of action quickly.
3. Then use the jet, quickly, to quench fragments and the remains of the bomb, and any fires it might have started.
4. Be absolutely sure all the fire is out before you leave the scene.
5. Use a coarse spray only where scattering of metal must be avoided.

6. Use sand only if a bomb falls where it is not likely to start a fire or if water is not available.

Since this recommended technique is a radical departure from that heretofore used, it may be well to give the reasons that prompted such a revision.

1. Speed in disposing of fire bombs is now known to be essential for a successful defense against incendiary fires. Several bombs commonly fall in a single home or other occupancy, and if much time is spent in disposing of one bomb, others may be given the opportunity of starting uncontrollable fires. The quickest possible way of dealing with a bomb is by using a jet of water, since the jet does, in a matter of seconds, the work that requires several minutes when the spray technique is used. By using a jet, several bombs lying nearby can be dealt with before any of them has time to do material damage.
2. Immediate attack upon the bomb may prevent the action of a burster attachment, thus removing its danger to the person fighting the bomb.
3. By using the jet, the operator can attack the bomb quickly, putting it out of action in less than a minute. The chance of a fire being started under the bomb is substantially reduced.
4. The undue emphasis thus far placed upon the bomb has directed the attention and thinking of civilians to the bomb, and not to the real danger—the fire started by the bomb.
5. The effect of the reaction that takes place when water strikes burning magnesium has been misinterpreted to consist of an explosion which may cause personal injury and increase the fire hazard. This exaggerated conception of the "terrors" of the bomb has instilled unjustified fear, which must be changed to a feeling of confidence on the part of civilians in their ability to cope with bombs. Due to the directional force of the jet, the scattering of the metallic fragments is away from the operator,

and therefore, his personal danger is minimized. Moreover, the operator can stand farther away from the bomb when using a jet than he can when using the spray.

6. The amount of water required to dispose of a bomb by the jet technique averages 5 quarts, much less than half that is needed for the spray treatment. Under certain circumstances, this economy of water may be of vital importance.

When a bomb is finally extinguished. the operator should examine the area under the bomb, so as to make sure that no hot metal has entered floor crevices and fallen between the beams where it may cause fire to rekindle. This thorough search may require the removal of floor boards and panelling.

In certain unusual situations, where there are concentrations of highly flammable materials, it may be essential to avoid scattering burning metal. Use a spray on the bomb only in such instances. While water is by far the best weapon for use on bombs, there are two situations where sand will be useful. First, if the bomb is where it is not likely to start a fire, sand may be dropped upon it, preferably contained in a sand bag. Secondly, if no water is available, the bucket-and-shovel sand technique may be used.

The Stirrup Pump, described in the chapter on Fire Extinguishers, is a good first aid appliance for these bombs. It is still manufactured with a dual purpose nozzle, a solid stream tip for ordinary use and a spray tip for use when particularly hazardous materials are present. Its 30 feet of hose enables the operator to fight the fire at a safe distance away from the intense heat. It is economical in the use of water. The bomb and fire, in the average room with ordinary furnishings can be extinguished in about five minutes with minimum damage (If there is adequate ventilation and help in replenishing water supplies).

The operator of this pump should lie flat to avoid excessive exposure to heat and fumes, keeping his face close to the floor for easier breathing and better visibility. If no table is convenient for protection against the explosive effects of the bomb, a blanket folded and wet will give protection.

Auxiliary Extinguishers on Bombs

Any extinguishing device which employs water in large quantities may be used on Electron Bombs. This does not mean dashing a pail of water on the burning bomb.

Knapsack pumps are of great value. Soda and Acid has only the effect of ordinary water to deal with the fire resulting from the bomb. Water under pressure from a garden hose nozzle is ideal.

Special extinguishing agents such as foam and carbon dioxide, which depend upon their smothering effect, are useless on incendiaries. Thermite supplies its own oxygen and hence its flames cannot be smothered. A carbon tetrachloride extinguisher not only would have no good effect upon the fire but it might also injure the operator by subjecting him to the toxic phosgene gas generated by contact with the molten magnesium metal.

Though at this time O.C.D. has not recognized the alleged Russian method of scooping a burning bomb of this character on a long handled shovel and dunking it in a sizeable container of water nearby, experiments are likely to be undertaken soon.

Sand

Under certain conditions, sand is valuable in attacking an incendiary bomb. It is not nearly as efficient as water, but may be used for the removal of the bomb from the premises to a place where it might burn with less harm. Where the floor is strong enough to resist penetration by the bomb and it is unlikely that the fire will spread to combustible substances, sand may be shoveled on the bomb after the priming composition has burned out. The sand will not extinguish the bomb but will reduce the heat sufficiently to enable the operator to shovel the bomb into a pail partly filled with sand, add more sand on top of the bomb and then carry the pail to the place of disposal.

The bomb should not be held long on the shovel or be placed directly on the bottom of the iron pail, for it will quickly burn through surfaces of thin sheet metal.

The operator should not leave the sand covered bomb on the floor of the premises. The fire is still burning under the sand and, if neglected, will extend or drop through the flooring.

Snuffers

A snuffer is semi-spherical in shape, similar to half of a large rubber ball. Made of asbestos, reinforced with wire and equipped with a long handle, it is used to cover a burning bomb, thereby confining the fire until it burns itself out. Use of the snuffer is limited to cases where there is no danger of the bomb burning through the flooring.

Penetration Power of An Electron Bomb

The Electron Bomb is designed to penetrate a roof constructed of ordinary material such as slate, asbestos shingles, or tile. Roofs of thick sheet metal or stone, so prevalent in New York City, may not yield to the impact of this bomb. After piercing a roof, the force of the bomb is usually spent and it lodges in a roof space or falls to the floor below. A lath and plaster ceiling below the roof will offer no resistance. A timber backing on the roof will stop the fall of the bomb but will resist the resulting fire for only a few minutes.

If the bomb lands in an attic that is accessible only with great difficulty, fire may spread throughout the entire house. Accordingly, flammable materials should be removed from all attics and roof spaces. If it will stand the weight, an attic floor should be protected by a layer of sand, 2 inches deep, to resist the bomb burning through the floor and thereby prevent the extension of the fire. Additional protection should be given rafters, beams and other exposed flammable surfaces by coating them with an approved fire-resistive preparation.

Other Incendiary Bombs

The main purpose of the small incendiary bomb, as has been stated before, is to start a great number of fires at the same time. The enemy hopes that the Fire Department will have neither the men nor the equipment to deal with the situation. Then, perhaps, all the small fires will spread and in joining together form a destructive conflagration.

If the purpose is to bomb a specific target, such as factory buildings or a fuel storage yard, heavier bombs are used. These contain various incendiary materials such as magnesium, phosphorous or oil which, when the bomb strikes, are scattered over a wide area and start a number of simultaneous fires among easily ignitable materials. Such bombs usually fall under one of the following types:

The Oil Bomb

This bomb is in the shape of a cylinder about 6 feet long and 1½-feet in diameter. Weighing between 350 and 400 pounds, it contains about 50 gallons of oil ordinarily used for lubricating crankcases. A small charge of TNT is sometimes added to disperse the contents. In exploding, these bombs scatter flaming oil a distance of 40 feet. If one penetrates the roof of a building, its weight will carry it through several floors and will usually destroy the building.

While the most effective extinguishing agent for the fire itself is foam, large quantities of water are used to wet down the surrounding combustible materials. A small, isolated oil fire may be smothered with sand.

The intense fire and heat and heavy smoke caused by the explosion of an oil bomb require the immediate action of Fire Department equipment. First-aid extinguishers are usually of little value.

The Phosphorus Bomb

Because of its self-starting properties, white phosphorus is a frequent ingredient in heavy bombs. This waxy substance bursts into flames on contact with air at ordinary temperature. When used in a bomb, the phosphorus is dissolved in carbon bisulphide, a highly inflammable liquid, and mixed with coal tar oil. Encased in a stream-lined cylinder, with a sharp pointed nose for better penetration, the entire bomb weighs at least 25 pounds.

A phosphorus fire may be extinguished with water but, when the materials have dried, will rekindle. Therefore, it is necessary to keep all surrounding materials wet until the phosphorus is removed. Great care must be exercised in handling the bomb because phosphorus, being a poison, will cause dangerous flesh burns. A phosphorus bomb may be identified by the odor and by the heavy white smoke.

"Calling Cards"

These are light discs of wet gun-cotton that contain a small pellet of phosphorus. Dropped from a plane, like small leaflets, the discs cover a wide target and remain where they fall for hours or weeks, depending upon temperature conditions. When the gun-cotton dries, the phosphorus, exposed to the air, ignites itself and the paper. This action produces a long, hot flame that will spread to flammable articles within striking distance.

Magnesium Bombs

The Magnesium-Thermite combination has been used in bombs in sizes larger than the Electron Bomb. One type, weighing 25 pounds, is enclosed in a case, fitted with a pointed nose to pierce its object. When such a bomb strikes the roof of a building, it will penetrate through several floors. The methods used in fighting fire resulting from Electron Bombs apply also to these larger bombs. Streams of water, however, must be proportionately larger to extinguish a greater volume of fire.

Multiple-Effect Bombs

These bombs are similar in appearance to the larger type

Magnesium Bombs, except that they contain several separate incendiary units. The one bomb, weighing 25 pounds, may house separate compartments of phosphorus and magnesium. The separate units are small and have little penetrating power after leaving the main bomb. Precautions applicable to the fighting of fires in these various chemicals must be adhered to in combatting the effects of this Multiple-Effect Bomb.

Harassing Bombs

One of the enemy's objectives, in bombing a city, is to fool, discourage, and if possible, scatter the fire-fighting forces. This is usually attempted in three ways:

1. *Whistles*
   Many bombs of all sizes are equipped with a small whistle that releases a terrifying scream while the bomb is falling. A fireman should try to remain calm and realize that the sound itself will cause no injuries.

2. *Smoke Bomb*
   On impact, these bombs release only heavy volumes of smoke. Firemen are sometimes decoyed away from the scene of an actual fire by this means.

3. *High Explosive Bombs*
   These demolition bombs reduce weak structures to combustible scrap, block the streets with debris, delay response of Fire Department apparatus and make the stretching of lines difficult.

The foregoing tells all that is known of existing types of bombs used by the enemy. The war is still on. Who knows but that, in spite of all our foreknowledge and preparedness, he may "come over" and subject us to a rain of fire different from anything used up to the present?

Other War Problems

IF THE FIRE DEPARTMENT IS FORCED TO OPERATE UNDER SEVERE war conditions, it may have to face more difficulties than combatting the effects of Incendiary Bombs. First, there is no guarantee that War Gases are permanently shelved. In fact, Japan's use of this terrible weapon against the Chinese has been recently reported. Secondly, there is the problem of emergency sources of water supply. Enemy action with High Explosive Bombs may rupture water mains and disable gatehouses and pumping stations to such an extent as to make our existing water system entirely useless. There will be other problems too, secondary means of communication, supplementing our Marine Division, etc. It may become necessary, following the experience of the English, to flank firemen with anti-aircraft batteries to protect them against the machine guns of hostile planes; even then, the fire-fighters will be subject to the spent anti-aircraft bullets of their own protectors. But these two, War Gases and Emergency Water Supply are the main problems. Each will be discussed in brief.

War Gases. (Fig. 133)

The term "gas" as used in a military sense, means any chemical substance, vapor, solid or liquid, that will cause a poisonous or irritating effect on a human being. These gases are first classified as persistent or non-persistent.

Persistent Gases

These agents evaporate slowly, while emitting their poisonous vapors. The vapors, chiefly due to their density, remain in an effective concentration at the point of release, for ten or more minutes. Some gases of this type will last for weeks or until definite steps are taken to decontaminate the area affected. Mustard Gas and Lewisite are examples of persistent gases.

Non-Persistent Gases

These agents form vapor clouds or smoke which, in drifting with the wind, loose their effectiveness at the point of release within ten minutes. Chlorine and phosgene are examples of non-persistent gases.

Classification By Effects

War gases are also classified according to their physiological effects, that is, their most pronounced effects on the human body. This division is generally used.

1. *LUNG IRRITANT*. The gas, when inhaled, causes irritation and inflammation of the bronchial tubes and lungs. Chlorine, the first chemical warfare material used in the first World War, and phosgene are outstanding examples of such a gas.

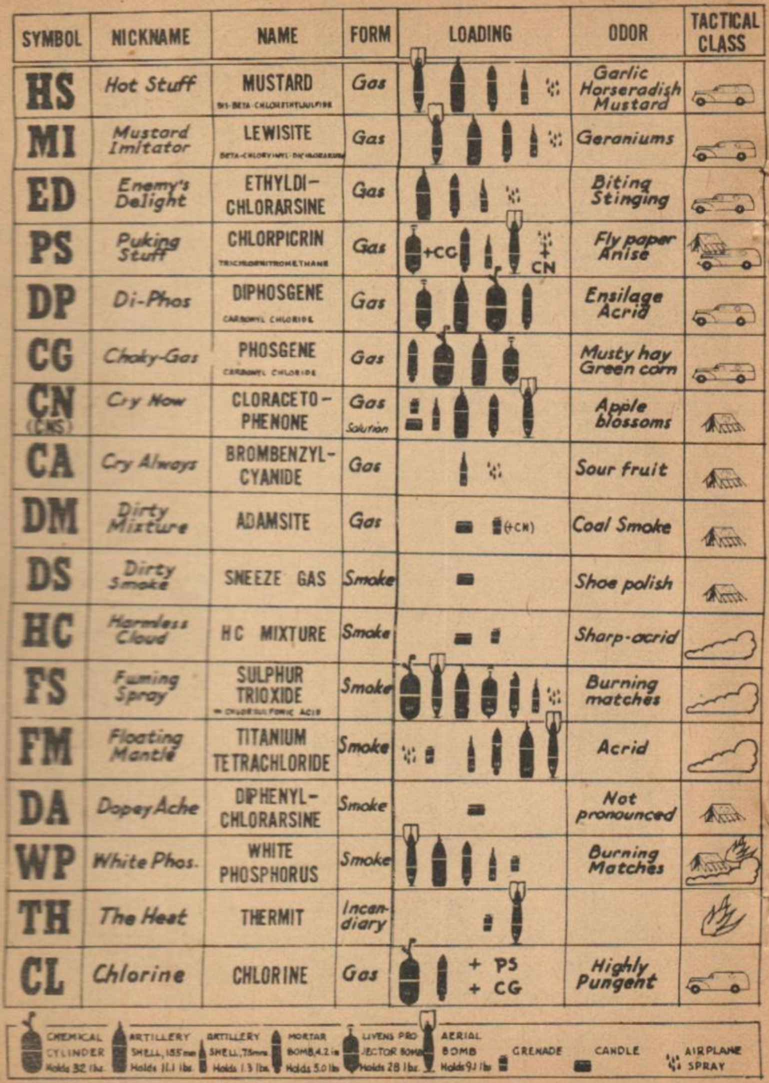
2. *VESICANT*. The vapor or liquid is absorbed into all parts of the body and is followed by inflammation, severe burns and the destruction of tissue. Protective clothing in addition to a gas mask, must be worn as a precaution against vesicants, best exemplified by mustard gas and Lewisite.

3. *LACRIMATOR*. Commonly known as tear gas, these substances cause violent weeping and severe but temporary eye irritation. Their principal employment is in teaching the proper and confident use of the gas mask.

4. *IRRITANT SMOKES OR STERNUTATORS*. These materials, filling the air in the form of minute solid or

CHEMICAL WARFARE AGENTS

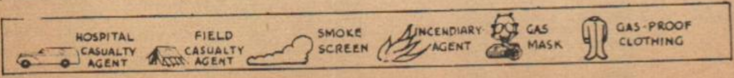
Prepared by Lt.-Col. Walter P. Burn, C.W.Res.



SYMBOL	NICKNAME	NAME	FORM	LOADING	ODOR	TACTICAL CLASS
HS	*Hot Stuff*	**MUSTARD** BI-BETA-CHLORETHYLSULFIDE	*Gas*		*Garlic Horseradish Mustard*	
MI	*Mustard Imitator*	**LEWISITE** BETA-CHLORVINYL-DICHLORARSINE	*Gas*		*Geraniums*	
ED	*Enemy's Delight*	**ETHYLDICHLORARSINE**	*Gas*		*Biting Stinging*	
PS	*Puking Stuff*	**CHLORPICRIN** TRICHLORNITROMETHANE	*Gas*	+CC + CN	*Fly paper Anise*	
DP	*Di-Phos*	**DIPHOSGENE** CARBONYL CHLORIDE	*Gas*		*Ensilage Acrid*	
CG	*Choky-Gas*	**PHOSGENE** CARBONYL CHLORIDE	*Gas*		*Musty hay Green corn*	
CN (CNS)	*Cry Now*	**CLORACETOPHENONE**	*Gas* *Solution*		*Apple blossoms*	
CA	*Cry Always*	**BROMBENZYLCYANIDE**	*Gas*		*Sour fruit*	
DM	*Dirty Mixture*	**ADAMSITE**	*Gas*	(+CN)	*Coal Smoke*	
DS	*Dirty Smoke*	**SNEEZE GAS**	*Smoke*		*Shoe polish*	
HC	*Harmless Cloud*	**HC MIXTURE**	*Smoke*		*Sharp-acrid*	
FS	*Fuming Spray*	**SULPHUR TRIOXIDE** IN CHLORSULFONIC ACID	*Smoke*		*Burning matches*	
FM	*Floating Mantle*	**TITANIUM TETRACHLORIDE**	*Smoke*		*Acrid*	
DA	*Dopey Ache*	**DIPHENYLCHLORARSINE**	*Smoke*		*Not pronounced*	
WP	*White Phos.*	**WHITE PHOSPHORUS**	*Smoke*		*Burning Matches*	
TH	*The Heat*	**THERMIT**	*Incendiary*			
CL	*Chlorine*	**CHLORINE**	*Gas*	+ PS + CG	*Highly Pungent*	

CHEMICAL CYLINDER Holds 32 lbs.
ARTILLERY SHELL, 155 mm Holds 11.1 lbs.
ARTILLERY SHELL, 75 mm. Holds 1.3 lbs.
MORTAR BOMB, 4.2 in Holds 5.0 lbs
LIVENS PROJECTOR BOMB Holds 28 lbs.
AERIAL BOMB Holds 9.1 lbs
GRENADE
CANDLE
AIRPLANE SPRAY

PHYSIOLOGICAL EFFECT	PROTECTION	FIRST AID	COLOR & STATE		PERSISTENCE	FIELD NEUTRALIZATION
			LOADED	RELEASED		
Burns skin or membrane. No immediate effect	😷 🥼	Remove clothing. Wash affected parts of body with gasoline, soapy water. Do not bandage.	HEAVY DARK, OILY LIQUID	Liquid slowly evaporates	Open 1 DAY Woods 1 WK to all winter	Cover with unslaked lime and earth. 3% sol'n of Na_2SO_3
Irritates nasal passages. Later skin burns, poison	😷 🥼	Wash with oil, hot water, soap. CUT AWAY small area of flesh. 5% sol'n NaOH. Apply Ferric Hydrate paste	DARK GREEN, OILY LIQUID	Slowly evaporates	Open-1 DAY Woods 1 WEEK	Wash down with water. Cover with earth. Alcohol. NaOH Spray.
Causes blisters, sores; paralysis of hands	😷 🥼	Wash with gasoline, hot water and soap			1 HOUR	Cover with earth, caustic, NaOH solution
Causes severe coughing, crying vomiting.	😷	Wash eyes, keep quiet and warm. Do not use bandages.	YELLOW OILY LIQUID	Colorless Gas	Open 6 HOURS Woods 12 HOURS	$Na\,SO_2$ - Sodium Sulfite in alcohol solution.
Causes coughing breathing hurts eyes water, toxic	😷	Keep quiet and warm. Give coffee as a stimulant.	COLORLESS LIQUID	Colorless Gas	30 MIN.	Alkali
Irritates lungs. Causes increasing doped feeling.	😷	Keep quiet and warm Give coffee as a stimulant.	COLORLESS LIQUID	Colorless Gas	10 to 30 MINUTES	Alkali
Makes eyes smart shut tightly, tears flow. Temporary.	😷	Wash eyes with water or boric acid. Do not rub or bandage. Skin, $NaCO_2$ soln.	BROWN CRYSTALLINE POWDER	Cloud of small, solid particles	10 MIN.	Strong, hot solution of Sodium carbonate
Eyes smart, shut, tears flow. Effect lasts some time	😷	Wash eyes with boric acid. Do not bandage.	DARK BROWN OILY LIQUID	Slowly evaporates	SEVERAL DAYS. (weeks in Winter).	Alcoholic Sodium hydroxide spray.
Causes sneezing, sick, depressed feeling.	😷	Remove to pure air and keep warm and quiet.	YELLOW-GREEN GRANULAR SOLID	Yellow Smoke	10 MIN.	Bleaching Powder Solution.
Causes, sneezing flow of tears.	😷	Remove to pure air and keep warm and quiet.	BLACK VISCOUS MASS	Grey Smoke	5 MIN.	None needed
Harmless.	NONE	Produces no effect requiring treatment	GREY SOLID	Grey Smoke	WHILE BURNING	None needed
Causes prickling of skin, flow of tears.	😷	Wash with Soda solution	CLEAR LIQUID	Dense white Smoke	5-10 MIN.	Alkaline Solution
Harmless	NONE	Produces no effect requiring treatment	YELLOWISH LIQUID	White Smoke	10-MIN.	None needed
Causes sick feeling and headache	😷	Remove to pure air, keep quiet. Sniff chlorine from bleaching powder bottle			Summer 10 MIN.	Bleaching Powder Solution.
Burning pieces adhere to skin, clothing.	NONE AVAILABLE	Plunge in mud to smother	PALE YELLOW SOLID	Burns to white smoke in Air	10 MIN.	Burns out.
5000 degree heat ignites materials.	Cover with earth, sand	Treat for severe burn			5 MIN	Quickly cover with earth or sand.
Lung Irritant	😷	Remove from gassed area Keep quiet and warm. Coffee as stimulant	YELLOW LIQUID	Yellow-green gas	10 MIN.	Alkaline Solution



liquid particles, cause sneezing, violent headaches, nausea and physical weakness. They never kill in concentrations met in the open. Protection from a gas of this type, such as Adamsite, requires the presence of a smoke filter in the canister of the gas mask.

5. *SYSTEMIC POISONS.* These materials either paralyze the body by attacking the heart and nerve reflexes, as in the case of hydrocyanic gas, or, like carbon monoxide, prevent the blood from distributing needed oxygen throughout the body. However, being lighter than air and easily diffused, these insidious gases are not suitable as chemical agents.

Figure (133) is a chart of the important war gases, including their identifying odors, their effects upon the human body, their other characteristics and approved methods of protection against them.

War gases may be placed in shells and shot from cannon, dropped in bombs or sprayed from low flying airplanes.

Decontamination of gases, not a Fire Department function, will be carried out by specially trained staffs. It usually consists of neutralizing the poisonous properties of the gas by the application of a harmless chemical.

Masks

The Army Gas Mask, designed to protect the respiratory system of the wearer against the effects of war gases, is a canister mask very similar to the All-Service type used by Fire Departments. However, its canister is not intended for use in confined areas where the concentration of a gas is more heavy in the open. The type mask now proposed for civilian use is called a "snout" mask because the canister, in the shape of a small cylinder, is attached directly to the face piece.

Emergency Water Supply

In anticipation of an enemy air raid, auxiliary sources of water supply are necessary for two reasons:

1. The regular water supply system may be wrecked or damaged beyond use.

2. An abnormal number of fires, occurring at the same time, will make increased demands on the regular system.

Therefore, it is wise to have an alternate supply for use in any emergency resulting from the failure of the normal source. Such auxiliary supplies will come from these sources.

1. *RIVERS.* Conveniently close to most parts of New York City is a limitless supply of salt water. Employing the principles of draughting and relaying water, this salt water can be pumped by fire-boats or pumping engines through long distances to a fire. Manhattan, completely surrounded by the North, East and Harlem Rivers, is fully protected. Every other Borough is at least partly protected in this way. Naturally, river water will be used as a last resort because of the serious health hazard involved, and because of the deteriorating effect it will have on private property and Fire Department apparatus.

   When a pumping engine is used to draft water from a beach, such as those found in Queens, Richmond and the outlying sections of Brooklyn and the Bronx, there is danger of the apparatus becoming imbedded in the sand. To overcome this difficulty, it is planned to construct at such locations small platforms sufficiently strong to hold the weight of a pumper.

2. *OTHER NATURAL SOURCES.* This City also has numerous small fresh water lakes and ponds, many natural wells and a few reservoirs. An inventory of these secondary sources of supply, including estimates of their volume and of the potential area to be protected, has been conducted by the Fire Department.

3. *ARTIFICIAL SOURCES.* The Department has carried

on a survey to list essential information relating to all existing artificial sources of water such as:

(a) Roof Tanks: Most tall buildings or those of extensive area are equipped with roof tanks to supply their standpipe and sprinkler systems. Streams originating from such a source would have an initial pressure due to the water descending from a height. Special fire pumps, if the building is so equipped, will assure additional pressure.

(b) Private Wells: Breweries, laundries, air-conditioning plants and many large factories draw their water supply from private wells, which could be converted to Fire Department use.

(c) Swimming Pools: These easily accessible sources, frequently located in hotels, clubs, public baths and amusement parks, store huge quantities of water. Inland residential sections of Brooklyn, too distant from the East River, and bay fronts, fortunately have many swimming pools.

4. *IMPROVISED SOURCES.* Even with the immense reserve of water from the previously listed sources, certain inland and hazardous sections of the City need a source of supply that can be put to instant use in an air raid. In such districts, several actions will be taken. Canvas water tanks, holding up to 5000 gallons will be erected in the streets and maintained full of water. Tank trucks, especially those of the Department of Sanitation, with a capacity of 3500 gallons, will be dispatched to areas where a shortage of water exists. Excavations and cellars of abandoned buildings will be flooded with a reserve of water, from which pumpers may draft a supply. Water used on one fire will flow into special traps to be reused on a second fire.

Provisions have been made for the emergency replacements of broken water mains by means of 3½-inch hose. If the rupture is localized, this hose will by-pass the water around the break; if extensive, the hose will be laid against the curb and salt water will be maintained in it under pressure from a fire-boat. Relay of water, with many regular engines and trailer pumps, working in tandem, and assisted by hose laying trucks, will also alleviate this condition.

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